CITY AND COUNTY OF DENVER

STATE OF COLORADO



DEPARTMENT OF PUBLIC WORKS / ENGINEERING DIVISION

BID DOCUMENTS PACKAGE

Contract No. 201206436

DENVER POLICE DEPARTMENT COMMAND VEHICLE GARAGE

June 6, 2012



Department of Public Works Engineering Division

Capital Projects Management – Dept. 506 Right-of-Way Services – Dept. 507 Policy and Planning – Dept. Dept. 509 Traffic Engineering Services – Dept. 508

> 201 West Colfax Avenue Denver, CO 80202 www.Work4Denver.com

NOTICE OF APPARENT LOW BIDDER

Golden Triangle Construction, Inc. 700 Weaver Park Rd Longmont, CO 80501

The MANAGER OF PUBLIC WORKS has considered the Bids submitted on July 19, 2012 for work to be done and materials to be furnished in and for:

CONTRACT NO 201206436 DPD COMMAND VEHICLE GARAGE

as set forth in detail in the Contract Documents for the City and County of Denver, Colorado. It appears that your Bid is fair, equitable, and to the best interest of the City and County; therefore, said Bid is hereby accepted at the bid price contained herein, subject to the approval and execution of the Contract Documents by the City in accordance with the Charter of the City and County of Denver, and to your furnishing the items specified below. The award is based on Lump Sum Bid Amount plus Add Alternates No. 1 and No. 2, the total estimated cost thereof being: One Million One Hundred Eighty-Six Thousand One Hundred Dollars and No Cents (\$1,186,100.00).

It will be necessary for you to appear forthwith at the office of the Department of Public Works, Contract Administration, 201 W. Colfax Ave., Dept 614, Denver, Colorado 80202, to receive the said Contract Documents, execute the same and return them to the Department of Public Works, Contract Administration within the time limit set forth in the Bid Proposal.

In accordance with the requirements set forth in the Contract Documents, you are required to furnish the following documents:

- a. Insurance Certificates: General Liability and Automotive Liability, Workman's Compensation and Employer Liability;
- b. One original plus two copies of the Power of Attorney relative to Performance and/or Payment Bond; and,

All construction Contracts made and entered into by the City and County of Denver are subject to Affirmative Action and Equal Opportunity Rules and Regulations, as adopted by the Manager of Public Works, and each contract requiring payment by the City of one-half million dollars (\$500,000.00) or more shall first be approved by the City Council acting by ordinance and in accordance with Section B1.12.2 of the Charter of the City and County of Denver.

Prior to issuance of Notice to Proceed, all Equal Opportunity requirements must be completed. Additional information may be obtained by contacting the Director of Contract Compliance at (720-913-1700).



NOTICE OF APPARENT LOW BIDDER PROJECT NO. 201206436 Page 2

ugo 2

The Bid Security submitted with your Bid, will be returned upon execution of the Contract and furnishing of the Performance Bond. In the event you should fail to execute the Contract and to furnish the performance Bond within the time limit specified, said Bid Security will be retained by the City and County of Denver as liquidated damages, and not as a penalty for the delay and extra work caused thereby.

Dated at Denver, Colorado this 67^{th} day of agust 2012.

CITY AND COUNTY OF DENVER

By Aln nar

Jose M. Cornejo, P.E. Manager of Public Works

JMC/tmg

cc: H. (CAO), Gallagher (AUD), Schellinger (Treasury/Tax Compliance), DSBO Inbox, M. Sheehan, Dick Gillet, Merritt (PW-Aud), PCO, File.

CITY AND COUNTY OF DENVER DEPARTMENT OF PUBLIC WORKS **Engineering Division**

BID FORM AND SUBMITTAL PACKAGE ACKNOWLEDGMENT

CONTRACT NO. 201206436

DENVER POLICE DEPARTMENT COMMAND VEHICLE GARAGE

BIDDER: Golden Triangle Construction Inc

r Park Rdd

ADDRESS:	700	Weave	er	Park	Rd
	Long	qmont	CO	80.	501

The undersigned bidder states that the undersigned bidder has received and had an opportunity to fully and thoroughly examine a complete set of the Contract Documents for Contract No. 201206436, DENVER POLICE DEPARTMENT COMMAND VEHICLE GARAGE, made available to the undersigned bidder pursuant to Notice of Invitation for Bids dated June 6, 2012.

The undersigned bidder acknowledges that a complete and final set of the Contract Documents for the referenced Project, the components of which are identified below, are bound and maintained as the record set of Contract Documents by the Contract Administration Division of the Department of Public Works and that this Record Set is available for examination by the undersigned bidder.

The undersigned bidder, having thoroughly examined each of the components identified below and contained in Contract Documents, HEREBY SUBMITS THIS BID FORM AND SUBMITTAL PACKAGE, fully understanding that the Contract Documents, as defined in Paragraph 1 of the contract, including this executed Bid Form and Submittal Package, constitute all of the terms, conditions and requirements upon which this submission is based and further understanding that, by submission of this Bid Form and Submittal Package, the City shall rely on the representations and commitments of the undersigned bidder contained herein.

The following completed documents comprising this Bid Form and Submittal Package will be included with and, by this reference, are expressly incorporated into the Contract Documents specified at Paragraph 1 of the Contract:

Bid Form and Submittal Package Acknowledgment Form Bid Form List of Proposed Minority/Woman Owned Business Enterprise(s) Commitment to Minority/Woman Owned Business Enterprise Participation Minority/Woman Owned Business Enterprise(s) of Intent Joint Venture Affidavit (if applicable) Joint Venture Eligibility Form (if applicable) Bid Bond Bidder / Contractor / Vendor / Proposer Disclosure Form Certificate of Insurance

1)

The following designated documents constitute that portion of the Contract Documents made available by the Notice of Invitation for Bids, but not included in the Bid Form and Submittal Package:

Notice of Invitation for Bids Instructions to Bidders Addenda (as applicable) Equal Employment Opportunity Provisions (Appendix A and Appendix F) Contract Form **General Contract Conditions** Special Contract Conditions Performance and Payment Bond Notice to Apparent Low Bidder Notice to Proceed Contractor's Certification of Payment Form Final/Partial Lien Release Form Final Receipt Change Orders (as applicable) Federal Requirements (as applicable) Prevailing Wage Rate Schedule(s) **Technical Specifications Contract** Drawings Accepted Shop Drawings

The undersigned bidder expressly assumes responsibility for the complete contents of these designated documents as bound together with the Bid Form and Submittal Package submitted herewith and designated the Contract Documents.

IN WITNESS WHEREOF, the undersigned bidder has signed personally or by duly authorized officer or agent and duly attested.

BIDDER:

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Name: Golden Triangle Construction Inc

By: Nakting Title: CEO

ATTEST: By S

Assistant Secretary

[SEAL]

CITY AND COUNTY OF DENVER DEPARTMENT OF PUBLIC WORKS Engineering Division

BID FORM

CONTRACT NO. 201206436

DENVER POLICE DEPARTMENT COMMAND VEHICLE GARAGE

BIDDER Golden Triangle Construction Inc

TO: The Manager of Public Works City and County of Denver c/o Contract Administration 201 West Colfax, Dept. 614 Denver, Colorado 80202

The Undersigned Bidder, having examined the plans, technical specifications, and remainder of the proposed Contract Documents as designated and enumerated in the General and Special Contract Conditions and any and all addenda thereto; having investigated the location of and conditions affecting the proposed Work; and being acquainted with and fully understanding the extent and character of the Work covered by this bid, and all factors and conditions affecting or which may be affected by Work, HEREBY SUBMITS THIS BID, pursuant to an advertisement of a Notice of Invitation for Bids as published on June 6, 2012, to furnish all required materials, tools, appliances, equipment and plant; to perform all necessary labor and to undertake and complete: CONTRACT NO. 201206436, DENVER POLICE DEPARTMENT COMMAND VEHICLE GARAGE, in Denver, Colorado, in full accordance with and conformity to the Plans, Technical Specifications, and Contract Documents hereto attached or by reference made a part hereof, at and for the following price(s) set forth on this Bid Form.

The following documents, which taken as a whole constitute the Contract Documents for this Project, and which are incorporated herein, by reference, were made available to the Bidder as provided in the Advertisement of Notice of Invitation for Bids, were received by the bidder, and form the basis for this bid:

Advertisement of Notice of Invitation for Bids Instructions to Bidders Commitment to M/WBE Participation Article III, Divisions 1 and 3 of Chapter 28, D.R.M.C. Bid Bond Addenda (as applicable) Equal Employment Opportunity Provisions (Appendix A and Appendix F) Bid.Form Contract Form General Contract Conditions Special Contract Conditions Performance and Payment Bond Notice to Apparent Low Bidder Notice to Proceed Contractor's Certification of Payment Form Final/Partial Lien Release Form Final Receipt Change Orders (as applicable) Federal Requirements (as applicable) Prevailing Wage Rate Schedule(s) Technical Specifications Contract Drawing Accepted Shop Drawings Certificate of Insurance

	Sum Base Bid Amount of: 2 Hundred Ninety Thousand Seven Hundred
	Dollars(\$_ 990;700)
Schedu	ale of Add Alternates (Specification 012300-1)
vehicle s	te #1: Install new evidence cage and all required mechanical, plumbing, electrical, structural scope at existing storage. <u>+y</u> Four <u>Thous and</u> <u>Dollars</u>
Alterna O~e (\$_ 7[te #2: Install heating and insulation at existing vehicle storage walls and roofs. Hundred Sevents One Thousand Three Hundred Dollars ,330 thirty
	te #3: Provide skid resistant epoxy floor sealer at new garage. <u>eeg-Thousand Six-</u> Hundred <u>Fifteon</u> Dollars Lo <u>15</u>
Fift	e #4: Install bus duct: Eliminate Direct Wire and Installation of 400 A Panel. <u>5</u> Bight ThousandDollars
Alternati Eight \$_18,	e#5: Provide 21" Solar tube skylights: teen Thousand Six Hundred Seventy File Dollars 675
	e #6: Paint all overhead structure and interior exposed walls and columns at new garage. <u>een Thousand One Hundred</u> Dollars 130
	e#7: Install interior loops for garage doors. <u>Thousand Five Hundred</u> Dollars
Suppler	mental Pricing Disclosure (Specification C-103):
	B' of excavation under building footprint & pavement area per Sheet S-001 Foundation Note 3 Three and $\frac{2\%00}{100}$ Dollars/Cubic Yard (\$ 3.20/Cy)
	B' of on-site backfill under building footprint & pavement area per Sheet S-001 Foundation Note 3 Six and $\frac{40}{100}$ Dollars/Cubic Yard (\$ 6, $\frac{40}{cy}$)
3. A	Additional excavation per Sheet S-001 Foundation Note 3 These and $\frac{20}{190}$ Dollars (Cubic Vard (\$ 3,20/())

BF-7 Engineering Division

.

4. Import Structural Fill per Sheet S-001 Foundation Note 3

³⁰/100 Dollars/Cubic Yard (\$ <u>30.30/cg</u>) and

5. Deduct for 2 PSI Gas Piping per Note on Sheet P-101

Deduct Eighteen Thousand Two Hundred Dollars Deduct (\$ 18,200)

If the Manager mails a written Notice of Apparent Low Bidder, addressed to the Bidder's business address stated on this Bid Form, the Undersigned Bidder shall, in accordance with the Contract Documents, be ready to, and shall, within five (5) days after the date of the Notice: (i) execute the attached form of Contract in conformity with this bid; (ii) furnish the required proofs of insurance; and (iii) furnish the required bond or bonds in the sum of the full amount of this bid, executed by a surety company acceptable to the Manager.

The $\frac{***}{}$, a corporation of the State of <u>CT</u>, is hereby offered as Surety on said bond. If such surety is not approved by the Manager, another and satisfactory surety company shall be furnished.

Enclosed with this bid is a bid guarantee, as defined in the attached Instructions to Bidders, in the amount of 5%. The Undersigned Bidder agrees that the entire amount of this bid guarantee is to be paid to and become the property of the City as liquidated damages, and not as a penalty, if: (i) the bid is considered to be the best by the City; (ii) the City notifies the Undersigned Bidder that it is the Apparent Low Bidder; and (iii) the Undersigned Bidder fails to execute the Contract in the form prescribed or to furnish the required bond and proofs of insurance, within five (5) days after the date of such notification.

The following persons, firms or corporations are interested with the Undersigned Bidder in this bid:

If there are no such persons, firms, or corporations, please so state in the following space:

No such person are interested

*** Hartford Accident and Indemnity Company

Contract No. 201206436 DPD CVG The Undersigned Bidder proposes to subcontract the following Work in accordance with General Contract Conditions, Title 5, SUBCONTRACTS, and represents that, to the greatest degree practical, all subcontractors known at the time of bid submittal have been identified.

Item of Work	Percent (%) of Total;	Proposed Subcontractor and Address
Concrete	Work 6.03	Plaza Construction, 845 Decatur St. Donver 80204
Painting	.33	Starr Painting & Drywall, 12649
Utilities	1.35	Mighty Earthword
Electric	13.12	MBRELOUTIC
Steel Election	2.14	Superior Steel Connectors Corp
Fencing	.34	Southwest Construction Supply I sales
Drywati	4.16	Independent construction
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(Copy this page if additional room is required.)

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	List of Pro MWBE o Bidders, Subo Suppliers (Manufact	or DBE	20 S ,	Office of Economic Development of Small Business Opportunity Compliance Unit 11 West Colfax Avenue, Dept. 907 Denver, CO 80202 Phone: 720-913-1999 Fax: 720-913-1803 DSBO@denvergov.org
City and County of De	nver Contract No. <u>No</u>	2012064	36 Denver Ro. rage	lice Command
The undersigned Bidder pa CURRENTLY certified by the the bid opening will count to for Brokers. MWBE or DB this page to list additional f	roposes to utilize the follow the City and County of Den toward satisfaction of the p E prime bidders must detai	ving MWBE on wer. Only the roject goal.	r DBE for the project. e level of MWBE or DE Only bona fide commis	All listed firms are BE participation listed at ions may be counted
Address:			Contact Person:	
Type of Service:			Dollar Amount: \$:	Percent of Project:
	MWBE or D	3E Prime E	lidden Sh	
Business Name: N/A				
Address:			Contact Person:	
Type of Service:			Dollar Amount: \$:	Percent of Project:
Subconfr	actors, Suppliers Manu	ufacturèrs.	or Brokers (check on	e box)
✓ Subcontractor (√)	Supplier (√)		Manufacturer (√)	Broker (√)
Business Name: Plaza	a Construction In	<u>C</u>	•	
Address: 845 Dec.	aturst. Denver	80204	Type of Service: (0)	ncrete
Contact Person: JVan	Alvidrez		Dollar Amount: \$: 60,710	Percent of 6.03 Project:
℃ Subcontractor (√)	Supplier (√)		Manufacturer (√)	Broker (√)
Business Name: Hnder	rendent constru	vetion 1	HP	
Address: 9248 14.0	ntario Drive, Litt	6ton w	Type of Service:	twall
Contact Person:	do corrales	30128	Dollar Amount: \$:	Percent of Project:
X Subcontractor (1/)	Supplier (√)		Manufacturer (√)	Broker (√)
Business Name: #56046	Co Enterprises 1	he		
Address: 4065 5. Fee	A Grail Bluck Show	ri dan	Type of Service: RH	ofing
Contact Person: Matthu	w Buck	80110-	Dollar Amount: \$:	Percent of Project:

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	List of Propo MWBE or DE Bidders, Subcont Suppliers (Manufacture	3E ractors,	Division of Si	e of Economic Development nall Business Opportunity Compilance Unit st Colfax Avenue, Dept. 907 Denver, CO 80202 Phone: 720-913-1999 Fax: 720-913-1803 DSBO@denvergov.org
City and County of Der	Ver Contract No.: <u>No. 20</u>	206436 Denv	er Polic	e.Comiand
CURRENTLY certified by the bid opening will count to	pposes to utilize the following N ne City and County of Denver. ward satisfaction of the projec prime bidders must detail the WBE or DBE.	Only the level of MV t goal. Only bona fid	VBE or DBE p le commisions	articipation listed at may be counted
Address:		Contact Pe	rson:	
Type of Service:		Dollar Amo	unt: \$:	Percent of Project:
	MWBE or DBE P	rime Bidder	a official contractions Before	
Business Name: N/A				
Address:		Contact Per	son:	
Type of Service:		Dollar Amou	unt: \$:	Percent of Project:
Subcontra	actors: Suppliers Manufac	urers or Brokers	(check one bo	x)
χ Subcontractor (\checkmark)	Supplier (√)	Manufacture	er (√)	Broker (√)
Business Name: Superi	or Steel Connector	s Corporation	Vi	
Address: 7404 Petc	rson Rd. Sedalia	CO Type of Serv	rice: Steel	Erection
Contact Person: Rongla	Gunn Bol	35 Dollar Amou 21,519	-	Percent of 2.14 Project: 2.14
X Subcontractor (√)	Supplier (√)	Manufacture		Broker (√)
Business Name: Southn	vest Constructions	upply I sala	sinc.	
Address: 2827 W.9	HAVE Denver 8020	Type of Serv	ice: Fenc	ina
Contact Person: Mike S	anche 2	Dollar Amou る、3つ	nt: \$: 74-	Percent of 34 Project: 34
Subcontractor (√)	Supplier (√)	Manufacture	. (√)	Broker (√)
Business Name: Indepe	endent construct	ion		
Address: 9248 W.	Owtonio Dr. Littlet	ON Type of Servi	ice: Dryn	1911
Contact Person: Fornal	ndo corrales 80.	128 Dollar Amour 41,4	nt: \$: 72	Percent of 4.16 Project:

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Subcontra	ctors, Suppliers Manu	facturers or Brokers (d	heck one box)
¥ Subcontractor (√)	Supplier (√)	Manufacturer (√)	Broker (√)
Business Name:	anne Design Gro	UP LFD-	
Address: 6989 E GIRA	rd Ave, Denver 80	Type of Service: Mc	tat Wall Panels
Contact Person: Mart	Suntain-	Dollar Amount: \$:	Percent of Project:
X Subcontractor (1)	Supplier (√)	Manufacturer (√)	Broker (√)
Business Name: StarrPa	unting & Drywal	1)	
Address: 12649 E Cal	ey Ave. #102	Type of Service: Par	nting
Contact Person: Charles Pol	lock Centennial 8	Dollar Amount: \$:3,3	Percent of Project: .33
X Subcontractor (√)	Supplier (√)	Manufacturer (√)	Broker (√)
Business Nam e: ABC F I	Te Protection		
Address: 160 Chambers	Rd. Aurona Boot	Type of Service: Type	Sprinkter
Contact Person: Steve SV	veet	Dollar Amount: \$:	Percent of Project:
\times Subcontractor ($$)	Supplier (√)	Manufacturer (√)	Broker (√)
Business Name: Triple	t concrete LLC		
Address: 2425 Willow	J Lane Longmont	Type of Service: Con	rcrete
Contact Person: Jessie D	bina 805	03 Dollar Amount: \$: 21	Percent of Project:
X Subcontractor $()$	Supplier (√)	Manufacturer (√)	Broker (√)
Business Name: Mighty	Earthworks	<u> </u>	
	oin five #440 .00	Type of Service: Ear	
Contact Person: Ecl Kahle	toreland 80	53 Pollar Amount: \$:/3,57	Percent of Project: /, 35
X Subcontractor (√)	Supplier (√)	Manufacturer (√)	Broker (√)
Business Name: MBREE	the Inc. MB	RELectric	
Address: 7/35 Newton	st. Westminster	Type of Service: Elec	trica 1
Contact Person: Keh VOSV	90030	Dollar Amount: \$:	Percent of Project: 13.12
✓ Subcontractor (√)	Supplier (√)	Manufacturer (√)	Broker (√)
Business Name: Stubble	field Electric		
Address: 21295 E.Ida Av	e, Centennia/ 80015	Type of Service: Elec	otric
Contact Person: Thomas S	tubblefield	Dollar Amount: \$:	Percent of Project: /5./3
		152359 Bid Form & S	ubmittal Package, Participation Page 1/07-dr

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The undersigned Bidder hereby certifies that the aforementioned subcontractors and suppliers have full knowledge that their names have been offered as subcontractors and suppliers for the work, and the Bidder further certifies that the dollar amount of work to be performed by the aforementioned M/WBE(s) was furnished to the Bidder prior to the bid opening. The undersigned Bidder agrees that after the bid opening, it shall submit to the City an executed and completed W/MBE "Letter of Intent" in three working days (3) on each of its M/WBE subcontractors. The "Letter of Intent" form is contained in the Contract Documents.

The undersigned Bidder acknowledges the right of the City to reject any or all bids submitted, to waive informalities in bids and to re-advertise this Project for bids.

The undersigned certifies that it has carefully checked all works and figures and all statements made in these Bid Forms.

This bid is submitted upon the declaration that neither, I (we), nor, to the best of my (xux) knowledge, none of the members of my (xor) kfirm or company have either directly or indirectly entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with this bid.

Business Addre	ss of Bidder:	700 Weave	r Park Rd				_
City, State, Zip	Code:	Longmont	<u>CO 80501</u>				
Telephone Num	ber of Bidder:	303-772-4	051	Fax No	303-776-6	525	
Social Security	or Federal Employer	ID Number of Bi	dder:	84-124	1307	- -	
Name and locati Boulder	on of the last work o Special Tra	fthis kind herein	contemplated upo der CO	n which the	Bidder was eng	aged:	· .
For information	relative thereto, plea	se refer to:	•				
Name:	Rich Johns	on		· .			
Title:	<u>Project Di</u>	rector	<u></u>				
Address:	345 Maxwel	l Boulder	CO 80301				
The undersigned	acknowledges recei	pt, understanding,	and full consider	ation of the f	ollowing adden	da to the Contract	Documents:
	Addend	a Number <u>1</u>	Date	July	2, 2012		
	Addend	a Number 2	Date	July	12, 2012		
	Addend	a Number	Date _				
Dated this 19	th day of	July	.20 12	4 - s			

Dated this

July day of 20 12

Signature of Bidder:

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If an Individual:	N/A	doing business
	as	· · · · · · · · · · · · · · · · · · ·
If a Partnership:	N/A	
	by:	General Partner.
If a Corporation:	<u>Golden Triangle Constr</u>	ruction Inc
	a Colorado	Corporation,
	by: Jeir Nading	, its Præskikit . CEC
Aitest:		
Sayaros Moha		
Assistant Se	- · , , , ,	
f a Joint Venture, signature of all Join		
Corporation (), Partnership ()	or () Limited Liability Company	
Ву:	(If a Corporat Attest:	ion)
Title:	Secretary	(Corporate Seal)
Firm:		
Corporation (), Partnership ()	or () Limited Liability Company	· · ·
Ву:	(If a Corporat	(on)
Title:	Attest:	
· .	Attest: 	(Corporate Seal)
	······································	
Title:	······································	
Title: Firm: Corporation (), Partnership () o	Secretary	(Corporate Seal)

COMMITMENT TO MWBE OR SBE DENVER* THE MILLE WIGH CITY	Office of Economic Development Division of Small Business Opportunity Compliance Unit 201 West Colfax Avenue, Dept. 907 Denver, CO 80202 Phone: 720-913-1999 Fax: 720-913-1803 DSBO@denvergov.org
The undersigned has satisfied the MWBE or SBE participant requirement, (Please check the appropriate box)	uirements in the following
The Bidder/Proposer is committed to a minimum of $\frac{25}{$	r SBE utilization on the project, sted in the Bid Forms as follows:
☐ The Bidder/Proposer is unable to meet the project goal of <u>25</u> % MWI minimum of <u>%</u> MWBE or SBE utilization on the project. The Bidder must submit a detailed statement of their good faith effort in accordance with of Ordinance 760 and must submit Letters of Intent for each MWBE or SBE II (3) business days after the bid opening or at time proposal is submitted.	Proposer understands that they DRMC Section 28-62 and 28-67
The Bidder/Proposer is a certified MWBE or SBE in good standing with the perform a minimum of% of the work on the contract.	he City and is committed to self-
Bidder/Proposer (Name of Firm): Golden Triangle Constructi	lon Inc
Firm's Representative (Please print): Jeff Nading	
Signature (Firm's Representative):	
Title: Chief Executive Officer	
Address: 700 Weaver Park Rd	
City: Longmont State: CO	Zip: 80501
Phone: 303-772-4051 Fax: 803-776-6525 E	mail: bidding@gtc1.net
A copy of the MWBE or SBE Certification <u>must</u> be a	attached.

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CITY AND COUNTY OF DENVER DEPARTMENT OF PUBLIC WORKS

CONTRACT NO. 201206436 PROJECT NAME: DENVER POLICE DEPARTMENT COMMAND VEHICLE GARAGE

ADDENDUM NO. 1 TO CONTRACT DOCUMENTS

Bidders are hereby instructed that the drawings, specifications, and other contract documents are modified, corrected, supplemented and/or superseded for the above mentioned project as hereinafter described in the following attachments:

BID FORM AND SUBMITTAL PACKAGE

None

BID DOCUMENT PACKAGE

BID POSTPONEMENT:

Notice is hereby given that Sealed Bids for Contract No. 201206436, DENVER POLICE DEPARTMENT COMMAND VEHICLE GARAGE is hereby postponed from July 12, 2012. Sealed bids will be received at the Office of Economic Development counter on the 2nd floor at 201 West Colfax, Denver, CO 80202 no later than:

11:00 a.m., Local Time July 19, 2012

Prior to submitting a bid, the bidder shall consult the Contractor's bulletin board, located on the 2nd floor at 201 W. Colfax Avenue, Denver, CO 80202 and/or www.work4denver.com.

Bid Opening will be held in Room 4.1.3.

This ADDENDUM shall be attached to, become a part of, and be returned with the Bid Proposal.

Berling Blernen Lesley B. Thomas

City Engineer

7.2.12

Date

The undersigned bidder acknowledges receipt of this Addendum. The Proposal submitted herewith is in accordance with the stipulations set forth herein.

> Golden Triangle Construction Inc Contractor

DATE: July 19,2012

Contract No. 201206436 CVG

ADDENDUM NO. 1

ADD- #1

July 2, 2012

CITY AND COUNTY OF DENVER DEPARTMENT OF PUBLIC WORKS Engineering Division

CONTRACT NO. 201206436 PROJECT NAME: DENVER POLICE DEPARTMENT COMMAND VEHICLE GARAGE

ADDENDUM NO. 2 TO CONTRACT DOCUMENTS

Bidders are hereby instructed that the drawings, specifications, and other contract documents are modified, corrected, supplemented and/or superseded for the above mentioned project as hereinafter described in the following attachments:

BID FORM AND SUBMITTAL PACKAGE

Replace pages BF-7 and BF-8 dated June 6, 2012 with attached pages BF-7 and BF-8 dated July 12, 2012.

BID DOCUMENT PACKAGE

None

SUPPLEMENTAL INFORMATION

Product substitutions will not be accepted prior to the Bid Opening on July 19, 2012. Any and all substitution requests will be evaluated and accepted and/or denied after the bid opening, and as per the process dictated by the Contract Documents.

Geotechnical Engineering Report (32 pages attached)

SPECIFICATIONS

Replace page 012300-2 Schedule of Alternates with attached page 012300-2

DRAWINGS (18 pages attached)

<u>Civil</u>

1. SHEET C-103

- a. Added note at existing water main/proposed sanitary service crossing for contractor pothole to field verify location, size and depth of the existing water main prior to construction.
- b. Added note under "Contractor Notes" to refer to A/S-001 for joint detail and joint spacing requirement note.

Architectural

2. SHEET G-002

- a. Bid Alternates 1, 2 reordered
- b. Bid Alternate 3: Install Arizona Polymer Flooring (APF) Vehicle Maintenance System at new garage interior; Color to be selected by Architect.
- 3. SHEET AS-101

Contract No. 201206436 DPD CVG

- a. Existing vinyl coated fence is 8'-0", relocate as needed.
- 4. SHEET A-101
 - a. Relocate Metro Swat, Crime Lab, New & Old Command Posts.

b. Relocate Electrical floor access vault.

5. SHEET A-301

a. Garage Doors, 306a, 306b, 307a, 307b changed to 16'-0" height

- 6. SHEET A-401
 - a. Revise height of fan to 16'-0" Min.

Structural

- 7. SHEET S-201
 - a. E/S-201 change wind girt elevation
- 8. SHEET S-202
 - a. D/S-202 change wind girt elevation
 - b. G, H, & K/S-202 brace frame connection modified due to change in wind girt elevation

Mechanical / Plumbing

- 9. SHEET M-001
 - a. Added list of Add Alternates.
- 10. SHEET M-101
 - a. Added notes to clarify Add Alternate scope.
 - b. Revised EF-1. Louvers by Mechanical
- 11. SHEET M-102
 - a. Added notes to clarify Add Alternate scope.
- 12. SHEET M-201
 - a. Revised detail C. Louvers by Mechanical
- 13. SHEET MEP-101
 - a. Revised EF-1. Louvers by Mechanical
- 14. SHEET P-100
 - a. Revised location of drains serving electrical floor access vault.
 - b. Added notes to clarify Add Alternate scope.
- 15. SHEET P-101
 - a. Added notes to clarify Add Alternate scope.

Electrical

- 16. SHEET E-200
 - a. Added Note #6, describing relocated light pole.
 - b. Depicted light pole to be relocated on site plan.
 - c. Added circuit on panel "LLVS" for heat trace
 - d. Added pole base detail
- 17. SHEET E-300
 - a. Modified note 7 to say bid alternate #4
 - b. Added note 23, for heat trace.
 - c. Relocated electrical vaults.
- 18. SHEET E-400
 - a. Added area demarcation to show areas to be included in each respective alternate
 - b. Added heats trace circuit on FR1B-41.
 - c. Added note #12 describing heat trace circuit requirements.

QUESTIONS AND ANSWERS

Question: On DWG C-103, it appears that a water line intersects the proposed new sanitary sewer service line. Can we get an approximate depth of the water line to determine if the water line is above or below the new service line?

City Response: RE: C-103. Selected contractor will be required to pothole and verify in field current depth.

Question: Pertaining to Alternate #3 is there a specific type of epoxy sealer that is required. City Response: Yes, RE: Sheet G-002 for specification.

Question: Is the contractor responsible for the cost of electricity and water usage? **City Response: Yes, per Section 015000 Temporary Facilities**

Question: Please provide door schedule. A301 shows a 7 section door typical for a (12x14) but scale has them at 12x15 of which is an 8 section door, What size is required?

City Response: Sectional doors are to be 12'-0" x 14'-6" and 12'-0" x 16'-0", RE: Elevations. Provide sections as needed.

Question: 083613 2.11 Door Assembly E. Operation cycles provide cycles required 10k, 20k 50k, 100K? **City Response: 25k**

Question: What cylinder core is required for the nema 4/12 02-409 per note on page A101. Standard cylinder or a best core?

City Response: Standard

Question: re Bid alternate 2. Are all requirements (note on page A101 for horn strobe and etc per note on page A101) same for this door as 12x14 doors

City Response: Match that provided for the doors at the adjacent (E) Enclosed Vehicle Cages. VIF.

Question: On pages M-101, M-102, P101, and E400 – Please clarify if the work at existing building is to be included in alternate #1.

City Response: Include all work in Alternate #2 (previously Alternate #1) between gridlines 7 and 25 except the following:

IR 1-6 and associated piping

Relocation of fire sprinkler at gridline 7

TD-2 at gridline 7 and associated piping

5" Gas main (which downsizes to 3") going to equipment between gridline 1 and 7

Question: Page P101 – There is a note that says "Verify gas pressure and provide deduct pricing for 2 PSI gas piping". There is no space on the bid form for us to provide this pricing. Please clarify (Also, would it be possible for the engineer to verify this before bid?).

City Response: Revised per drawings. Provide deduct for 2psi gas piping per the note on Sheet P-101

Question: Please clarify that note #7 on page E-300 should read "bid alternate #4" **City Response: This is correct.**

Question: Who is the manufacturer of the existing security system? **City Response: Software House**

Question: Is note #9 on page E-400 supposed to be included in alternate #2? City Response: Yes, this work is to be part of Alternate #1 (previously Alternate #2)

Question: Please provide the height of the walls that are to be insulated under Bid Alternate #1 City Response: Walls are roughly 13'-6" +- depending on slope. VIF Question: Is the Mechanical work shown in the existing building west of gridline 7 to be part of Bid Alternate #1 City Response: Yes, this work is to be part of Alternate #2 (previously Alternate #1).

Question: Please clarify if the refrigerant piping work indicated on sheet M-102 is to be part of Bid Alternate #1 City Response: Yes, this work is to be part of Alternate #2 (previously Alternate #1).

Question: Please clarify if the scope of work for electrical shown on sheet E-400 is to be part of Bid Alternate #1 City Response: Yes this work is to be part of Alternate #1 (previously Alternate #2)

Question: Please define the materials and systems that is required to be demolished and/or modified at the north building elevation for Bid Alternate #2

City Response: Existing Kalwall System to be modified to accommodate relocated door and new garage door.

Question: Please clarify if the new sanitary piping and associated trench drain indicated between gridlines 7 and 23 is to be part of Alternate #2

City Response: Yes, this is to be part of Alternate #1 (previously Alternate #2)

Question: Please provide information for painting system/products that are to be used at Concrete Substrates, non traffic surfaces, for Bid Alternate #6.

City Response:

For Steel: Primer=Benjamin Moore, Super Spec HP Primer for Steel Paint=Super Spec HP DTM, Acrylic Semi-Gloss P-29

For Concrete: Sealer = Super Spec 100% Acrylic Masonry seal (066) Paint = Ultra Spec 500 – Interior Semi-Gloss Finish (539)

Question: The route for the new sanitary line will require the removal of existing landscaping between the parking lots. Please indicate the landscape material that is to be replaced (i.e. native seeding, sod, etc.). City Response: Seed mix: Blue grama (40%) and Buffalograss (60%) to match existing

Question: Exterior concrete aprons have no indication of reinforcing being required. Please provide reinforcing requirements if any are required.

City Response: 6" concrete at 4000psi, and reinforcing should consist of #4 rebar at 24" O.C. both ways

Question: Please provide soils report as referenced in Contractor Notes on sheet C-102. **City Response: See attached**

Question: Is it acceptable to bore the new electrical feeders and conduit for the security wiring. **City Response: Yes, boring for conduit for security wiring is acceptable.**

Question: Note 7 on sheet E-300 indicates requirements for drop cords for Bid Alternate #2. We believe this requirement is intended to be for Alternate #4. Please review and clarify. City Response: Correct – the related alternate is #4. Please note that drop cords are to be included in base bid and the alternate pertains to the method of feeding power (busway versus panelboard).

Question: During the pre-bid meeting it was indicated that background checks would be required for all personnel that will be on the project site. Please provide the requirements of the background check including who is responsible for the associated fees (City and County of Denver or Employer) as well as the previous offenses of an individual that would preclude them from being able to perform work on the project.

City Response: Security check requirements will be provided to the successful bidder

Question: Can we get a distance from Gridline 25 back to the point of tie in for the new water service shown on Sheet P101?

City Response: The estimated distance from gridline 25 to the water entry room is approximately 200'. Contractor to field verify exact length.

Question: We cannot find any reference to the Heat trace location on the Electrical Drawings for final connection. City Response: See revised plan (E-300, note 23) showing 20A circuit for heat trace. Coordinate exact locations with mechanical / plumbing plans & schedules.

Question: Under the "General Mechanical Contract Requirements" Louver section it states that "all louvers located on exterior walls shall be provided by architectural division". Building elevations reference mechanical for louvers. No specification has been provided for louvers under the architectural divisions. Please advise which division is responsible for exterior louvers and provide necessary product information for bidding. **City Response: Louvers provided by Mechanical, RE: drawings.**

Question: Architectural site plan indicates an existing site light pole to be relocated. Electrical drawings provide no information regarding the routing of circuit, location of connection for light circuit, nor pole base for a light pole. Please clarify.

City Response: Refer to revised plan (E-200, note 6) and detail showing pole base requirements.

Question: Sheet S-101 foundation plan makes reference to electrical vaults below the slab. Sheet E-300, detail 1 shows these as cast-in-place. Please clarify if these are required to be pre-cast or cast-in-place. City Response: Vault construction shall be per E-300, and be incorporated into the slab-on-grade construction

Question: Please specify the trench drain assembly.

City Response: The trench drain assembly is specified on the drawings. Reference sheet P-101 for the schedule of this drain and sheet P-100 for location and details.

Question: Specification section 311001- Earthwork indicates that excavation for footing and foundations is not to extend deeper than bottom of foundation. Note 3 under "Foundations" on Sheet S-001 indicates that the base bid is to include 8' of over excavation and re-compaction with on-site materials. Note 3 also indicates that we are to provide unit prices for over excavation and re-compaction with onsite material as well a importing and placing structural fill. Please clarify what is to be included in base bid and provide bid form with unit prices section if required.

City Response: Referenced spec section is incorrect. Depth of over-excavation under proposed building footprint and pavement shall be per General Note 2 & 3 under Foundation section on Sheet S-001.

Question: Bid form indicates "Supplemental Pricing Disclosure" which reference note #1 and note #2 in the descriptions. Please provide the location in the bid documents of note #1 and note #2 referenced. City Response: References to notes #1 & #2 are incorrect. These were originally located on Sheet C-103 under Contractor Earthwork Notes but now occur on Sheet S-001.

Question: Can you provide the Geotechnical Report by Yeh & Associates of March 26, 2009 referenced in note #1 on C-102?

City Response: Yes, attached.

Question: Is there specified start & substantial completion dates for this project? City Response: 270 Days from Issuance of Notice to Proceed. This ADDENDUM shall be attached to, become a part of, and be returned with the Bid Proposal.

Lesley B. Thomas City Engineer . 7 Date

The undersigned bidder acknowledges receipt of this Addendum. The Proposal submitted herewith is in accordance with the stipulations set forth herein.

Golden Triangle Construction In(Contractor

ADDENDUM NO. 2

DATE: July 19,2012



GEOTECHNICAL ENGINEERING REPORT

DENVER TRAFFIC OPERATIONS AND POLICE FIRING RANGE GLOBEVILLE ROAD AND FOX STREET DENVER, COLORADO

PROJECT NO. 28-264 March 26, 2009

Prepared For:

Humphries Poli Architects 2100 Downing Street Denver, Colorado 80205 Attn: Mr. Adam Ambro

Prepared By:

Yeh and Associates, Inc. 5700 East Evans Avenue Denver, Colorado 80222 Phone: 303-781-9590 Fax: 303-781-9583



March 26, 2009

Project No. 28-264

Humphries Poli Architects 2100 Downing Street Denver, Colorado 80205

Attn: Mr. Adam Ambro

Subject: Geotechnical Engineering Investigation, Denver Traffic Operations and Police Firing Range Denver, Colorado

Dear Mr. Ambro:

Yeh and Associates is pleased to present the results of our geotechnical investigation for the proposed project. Our work consisted of subsurface exploration, laboratory testing, engineering analyses and preparation of this report and was performed in general accordance with our proposal dated September 2, 2008.

The subsurface conditions at the site generally consisted of sand and clay fill overlying silty sands. The clays were non-expansive at the in-situ moisture content. The sands are also considered to be non-expansive.

Based on the site conditions, proposed construction and our engineering analyses, we believe the proposed building can be supported on a spread footing foundation system bearing on native soils or engineered fill. The interior floor slabs can use slab-on-grade construction provided the subgrade materials are the on-site soils or engineered fill. Based on the nature of the existing fill, we recommend removal and recompaction or some other ground modification prior to construction. Our design and construction recommendations are presented in the report.

We appreciated the opportunity to be of service to you during this phase of the project and look forward to assisting you during the final design and construction phases. If you have any questions regarding this report or need additional information or services, please feel free to contact the undersigned in our Denver office.

YEH AND ASSOCIATES, INC.

Jere A. Strickland, P.E. Senior Project Manager



Shan-Tai Yeh, P.E. Principal

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GEOTECHNICAL ENGINEERING REPORT

INTRODUCTION

This report contains the results of our geotechnical engineering exploration for the proposed project to be located at the west side of the intersection of Globeville Road and Fox Street in Denver, Colorado, as indicated on the Boring Location plan.

Our services were to provide information and geotechnical engineering recommendations relative to:

- ?? subsurface soil and bedrock conditions;
- ?? groundwater conditions;
- ?? foundation design and construction;
- ?? floor slab design and construction;
- ?? pavement design and construction;
- ?? earthwork; and
- ?? drainage.

The recommendations contained in this report are based upon our understanding of the proposed project, the results of field and laboratory testing, engineering analyses and our experience with similar soil conditions and structures.

PROPOSED CONSTRUCTION

The project includes renovation of a portion of the existing Park Avenue warehouse, which is currently occupied by City and County of Denver offices. The remaining portion of the site is currently occupied by a City and County of Denver street maintenance facility, which includes a 'tented' garage and above-ground storage tanks. The renovated portion of the building will be for the Traffic Operations Department. A new building is proposed for the Denver Police firing range, which will have an attached two-story parking garage on the north side. The firing range will be a single-story building with a slab-on-grade floor, approximately 16,000 square feet in plan size. A future covered parking area is proposed adjacent to the north end of the parking garage. The cover parking area will be approximately 15,000 square feet in plan size. Access drives and some additional parking areas are also proposed as part of site development.

Site grading plans provided for the project, indicate finished floor elevation for the firing range and parking garage to be 5173.20, which is near existing grade elevation at the site. Therefore, only minor site grading is anticipated within the building footprint and for the adjacent pavement areas.

SITE EXPLORATION

The scope of the services performed for this project included site reconnaissance by a representative of Yeh and Associates, a subsurface exploration, laboratory testing and engineering analysis.

A total of nine test borings were drilled on March 2, 2009 to depths of about 5 to 21 feet below existing site grade at the approximate locations shown on the Boring Location plan. Of the

borings, six were drilled within the proposed firing range building and adjoining parking garage footprint, one boring was drilled in the future covered parking area and two borings were drilled in proposed pavement areas. The borings were advanced with a truck-mounted drilling rig, utilizing 4-inch diameter, solid-stem, continuous-flight auger.

The borings were located in the field by pacing from property lines and/or existing site features. The accuracy of boring locations should only be assumed to the level implied by the method used.

Logs of subsurface conditions were recorded for each boring by our representative during the drilling operations. At selected intervals, samples of the subsurface materials were taken by driving California barrel samplers. Representative bulk samples of subsurface materials were also obtained from selected borings.

Penetration resistance measurements were obtained by driving the California barrel into the subsurface materials with a 140-pound hammer falling 30 inches. The penetration resistance value is a useful index to the consistency, relative density or hardness of the materials encountered.

Groundwater measurements were made in each boring at the time of site exploration.

LABORATORY TESTING

Samples retrieved during the field exploration were returned to the laboratory for observation by the project geotechnical engineer and were classified in accordance with the Unified Soil Classification System. An applicable program of laboratory testing was developed to determine engineering properties of the subsurface materials. Following the completion of the laboratory testing, the field descriptions were confirmed or modified as necessary and Boring Logs were prepared. These logs are presented in Appendix A.

Laboratory test results are presented in Appendix B. These results were used for the geotechnical engineering analyses and the development of foundation, pavement and earthwork recommendations. Laboratory tests were performed in general accordance with the applicable local or other accepted standards.

Selected soil samples were tested for the following engineering properties:

- ?? Water content
- ?? Dry density
- ?? Grain size
- ?? Plasticity Index
- ?? Swell/Settlement
- ?? Water soluble sulfate content

SITE CONDITIONS

The site was occupied by the Park Avenue warehouse and the street maintenance facility. The warehouse will remain on the site. However, the 'tented' garage facility and above-ground tanks

associated with the street maintenance facility will be removed for construction of the firing range and parking garage.

The ground surface was relatively flat with a gentle slope to the south. Vegetation consisted of several landscaped areas with grass, bushes and trees near the warehouse building and parking lot, sparse native grasses and weeds covered the remaining portions of the site not occupied by the street maintenance operations. Site drainage was generally in the form of sheet flow directed to the south towards the South Platte River, although shallow depressions existed.

CONCLUSIONS AND RECOMMENDATIONS

Geotechnical Considerations

The site appears suitable for the proposed construction. However, up to 8 feet of fill was encountered in the borings drilled at the site. We have not been provided with any information regarding whether the fill was placed under the observation of a geotechnical engineer. Given the age of the site development and the location of the fill on the site, it is unlikely the fill was placed under the observation of a geotechnical engineer.

Based upon the presence of construction debris and the variability of the in-situ dry densities and moisture contents, it is our opinion that the existing fill should not be used for support of foundations, floor slabs-on-grade and pavements without complete removal and recompaction. Some additional site investigation could be conducted to further evaluate the nature of the existing fill materials. This site investigation should include test pits and in-place moisture density testing as well as sampling and laboratory testing for characterization of the fill. Based on the additional site investigations, some portions of the fill may not need to be removed if they are properly constructed and determined to be suitable for structure or slab support.

These recommendations address the geotechnical considerations of the existing fill. Environmental considerations may dictate other site development constraints. Current State of Colorado requirements may also dictate the need for evaluation of the fill and/or debris for asbestos. If the environmental considerations limit the removal of the existing fill, Yeh and Associates should be informed and alternate recommendations could be provided based on discussions with the design team.

Our services did not include delineating the horizontal or vertical extent of the existing fill material. In addition, it should be noted that there exists the potential for construction debris and/or domestic trash to be encountered within the fill on some portions of the site. However, based upon the boring log data, the potential is considered to be low.

This should be verified by additional geotechnical investigations at the site. If additional exploration is not performed, the owner should make allowances for such conditions to exist in the preparation of the project budget and/or construction plans. It appears the construction debris encountered was not considered to be potentially asbestos containing material. However, if during construction, debris is encountered that may be asbestos containing, additional site investigations will be needed to address the State of Colorado's requirements on asbestos contamination of soils.

Foundation Systems

Due to the presence of non-expansive soils on the site, a spread footing foundation bearing upon undisturbed soils and/or engineered fill is recommended for support of the proposed structures. The footings may be designed for a maximum bearing pressure of 3,000 pounds per square foot (psf). The design bearing pressure applies to dead loads plus design live load conditions. The design bearing pressure may be increased by 1/3 or as allowed by local code when considering total loads that include wind or seismic conditions. Recommended minimum widths of column and wall footings are 24 inches and 18 inches, respectively.

If unsuitable bearing soils are encountered in footing excavations, the excavations should be extended deeper to suitable soils. The footings could be extended to bear directly on the deeper soils or the excavation backfilled with engineered fill or lean concrete backfill placed in the excavations.

Exterior footings should be placed a minimum of 36 inches below finished grade for frost protection and to provide confinement for the bearing soils. Interior footings should bear a minimum of 12 inches below finished grade. Finished grade is the lowest adjacent grade for perimeter footings and floor level for interior footings.

Footings should be proportioned to reduce differential foundation movement. Proportioning on the basis of equal total movement is recommended; however, proportioning to relative constant dead load pressure will also reduce differential movement between adjacent footings. Total movement resulting from the assumed structural loads is estimated to be on the order of 1 inch or less. Differential movement should be on the order of ½ to ¾ of the estimated total movement. Additional foundation movements could occur if water from any source infiltrates the foundation soils, therefore, proper drainage should be provided in the final design and during construction.

Areas of low density natural soils may be encountered at foundation bearing depth. When such conditions exist beneath planned footing areas, the subgrade soils should be removed to a minimum depth of 12 inches and a minimum of 12 inches horizontally beyond the edge of the footings. The soils should be replaced as engineered fill or with lean concrete or gravel.

Footings, foundations and masonry walls should be reinforced as necessary to reduce the potential for distress caused by differential foundation movement. The use of joints at openings or other discontinuities and at periodic intervals on long masonry walls is recommended.

Foundation excavations should be observed by the geotechnical engineer. If the soil conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

Seismic Considerations

No active faults are known to exist in the immediate site area, and fault rupture is not a credible hazard at the site. The soils at the site correspond with Site Class D of the IBC. We recommend the following site coefficients be used.

Design acceleration for short periods

Ss	Fa
<0.2	1.6

 S_s = The mapped spectral accelerations for short periods F_a = Site coefficient from Table 1615.1.2(1)

Design acceleration for 1-second period

S ₁	F _v
<0.06	2.4

 S_1 = The mapped spectral accelerations for 1-second period F_v = Site coefficient from Table 1615.1.2(2)

Floor Slab Design and Construction

Non-expansive or only low expansive soils or engineered fill will support the floor slab. Some differential movement of a slab-on-grade floor system is possible should the subgrade soils become elevated in moisture content. To reduce potential slab movements, the subgrade soils should be prepared as outlined in the Earthwork section of this report.

For structural design of concrete slabs-on-grade, a modulus of subgrade reaction of 200 pounds per cubic inch (pci) may be used for floors supported on native soils or engineered fill consisting of on-site soils.

Additional floor slab design and construction recommendations are:

- ?? Positive separations and/or isolation joints should be provided between slabs and all foundations, columns or utility lines to allow independent movement.
- ?? Control joints should be provided in slabs to control the location and extent of cracking.
- ?? Interior trench backfill placed beneath slabs should be compacted in accordance with recommended specifications outlined herein.
- ?? If moisture-sensitive floor coverings are used on interior slabs, consideration should be given to the use of barriers to minimize potential vapor rise through the slab.
- ?? Floor slabs should not be constructed on frozen subgrade.
- ?? Other design and construction considerations, as outlined in Section 302.1 R of the "ACI Design Manual", are recommended.

Pavement Design and Construction

Design of pavements for the project has been based on the procedures outlined in the "Guideline for Design of Pavement Structures" by the American Association of State Highway and Transportation Officials (AASHTO). Areas within proposed pavements on the site will be divided into two categories based upon anticipated traffic and usage. Traffic criteria assumed for pavement thickness designs includes 18-kip equivalent single-axle loads (ESAL's) of 36,500 for automobile parking and 72,000 for driveways. These traffic loads should be verified with the final design traffic volumes.

Local drainage characteristics of proposed pavement areas are considered to vary from fair to good depending upon location on the site. For purposes of this design analysis, fair drainage characteristics are considered to control the design. These characteristics, coupled with the approximate duration of saturated subgrade conditions, result in a design drainage coefficient of 1.0 when applying the AASHTO criteria for design.

For flexible pavement design, a terminal serviceability index of 2.5 was utilized along with an inherent reliability of 85 percent and a design life of 20 years. Based on the classification of the subgrade materials and our experience, we believe the subgrade materials roughly correlate to an R-value of 25. Using the correlated design R-value, appropriate ESAL, environmental criteria and other factors, the structural numbers (SN) of the pavement sections were determined on the basis of the 1993 AASHTO design equation.

In addition to the flexible pavement design analyses, a rigid pavement design analysis was completed based upon AASHTO design procedures. Rigid pavement design is based on an evaluation of the Modulus of Subgrade Reaction of the soils (K-value), the Modulus of Rupture of the concrete, and other factors previously outlined. The design K-value of 200 pci for the subgrade soil was determined by correlation to the laboratory test results and the Colorado Department of Transportation Figures 2.6 and 2.7 from the 2008 Pavement Design Manual. A modulus of rupture of 650 psi was used for pavement concrete. The rigid pavement thickness for each traffic category was determined on the basis of the AASHTO design equation.

Traffic Area	Alternative -	Pavement Section Thickness (inches)			
		Asphalt Concrete Surface	Aggregate Base Course	Portland Cement Concrete	Total
Automobile Parking	Α	5			5
	В	3	7		10
	С			5	5
Main Drives and Firelanes	Α	5½			5½
	В	31⁄2	7		10½
	С			5½	5½

Recommended alternatives for flexible and rigid pavements are summarized for each traffic area are:

Subgrade Preparation

Prior to placing the pavement section, the subgrade should be scarified to a depth of 12 inches, adjusted to a moisture content between optimum and 3 percent above optimum moisture content and compacted to 95 percent of the maximum standard Proctor density.

The entire pavement subgrade should be proofrolled with a heavily loaded pneumatic-tired vehicle after preparation. Pavement design procedures assume a stable subgrade. Areas that deform under heavy wheel loads are not stable and should be removed and replaced to achieve a stable subgrade prior to paving.

Pavement Performance

The pavement performance can be enhanced by minimizing excess moisture migration into the subgrade soils. The following recommendations should be considered at minimum:

- ?? site grading at a minimum 2 percent grade away from the pavements;
- ?? compaction of any utility trenches entering the pavement subgrade from adjacent landscaped areas to the same criteria as the pavement subgrade;
- ?? reducing or eliminating landscaped areas in or adjacent to pavements to minimize or prevent moisture migration to subgrade soils;
- ?? placing compacted on-site backfill against the exterior side of curb and gutter; and
- ?? placing curb, gutter and/or sidewalk directly on subgrade soils without the use of base course materials.

Pavement Preventative Maintenance Recommendations

Preventative maintenance should be planned and provided for through an ongoing pavement management program to enhance future pavement performance. Preventative maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment.

Preventative maintenance, which consists of both localized maintenance, such as crack sealing and patching, and global maintenance, such as surface sealing, is usually the first priority when implementing a planned pavement maintenance program and provides the highest return on investment for pavements.

Recommendations for maintenance of asphalt and jointed concrete pavements, based upon type and severity of distress, can be are provided. Prior to implementing any maintenance, additional engineering observation is recommended to determine the type and extent of distress and the appropriate preventative maintenance.

Additional Design and Construction Considerations

Exterior Slab Design and Construction

Exterior slabs-on-grade, exterior architectural features, and utilities founded on or in backfill may experience some movement due to the volume change of the backfill. Potential movement could be reduced by:

- ?? minimizing moisture increases in the backfill;
- ?? controlling moisture-density during placement of backfill;
- ?? using designs which allow vertical movement between the exterior features and adjoining structural elements; and
- ?? placing effective control joints on relatively close centers.

The on-site clayey and silty soils, whether native or used in fills, have some susceptibility to frost heave. Therefore, movement may occur in exterior concrete slabs, which can result in off-sets, tilting and cracking. The movement and cracking may affect the appearance and performance of the slabs and can affect the slab's compliance with ADA/FHA requirements. There are several options to improve the slab's appearance and performance, however, these options are not solely related to geotechnical mitigation measures and there are sometimes significant costs associated with mitigation of the potential movement. It is suggested that if the exterior slab performance is critical to the project, the owner and design team discuss the required slab performance and options to improve performance. Yeh and Associates should be contacted to participate in these discussions.

Corrosion Protection

Samples of the soils were tested for determination of water-soluble sulfate concentration. Test results indicated the concentrations to be 0.007 percent to 0.008 percent. These concentrations of water-soluble sulfates represent a negligible degree of sulfate attack on concrete exposed to these materials. The degree of attack is based on a range of negligible, positive, severe and very severe as presented in the U.S. Bureau of Reclamation Concrete Manual. Results of soluble sulfate testing indicate that ASTM Type I Portland cement could be specified for all project concrete on and below grade. However, if there is no (or minimal) cost differential, use of ASTM Type II Portland cement is recommended for additional sulfate resistance of construction concrete.

Surface Drainage

Positive drainage should be provided during construction and maintained throughout the life of the proposed project. Infiltration of water into utility or foundation excavations must be prevented during construction. Planters and other surface features that could retain water in areas adjacent to the building or pavements should be sealed or eliminated. In areas where sidewalks or paving do not immediately adjoin the structure, we recommend that protective slopes be provided with a minimum grade of approximately 5 percent for at least 5 feet from perimeter walls. Backfill against footings, exterior walls and in utility and sprinkler line trenches should be well compacted and free of all construction debris to reduce the possibility of moisture infiltration and migration.

Downspouts, roof drains or scuppers should discharge into splash blocks or extensions when the ground surface beneath such features is not protected by exterior slabs or paving. Sprinkler systems should not be installed within at least 5 feet of foundation walls and outside of the foundation backfill zone. Landscaped irrigation adjacent to the foundation system should be eliminated.

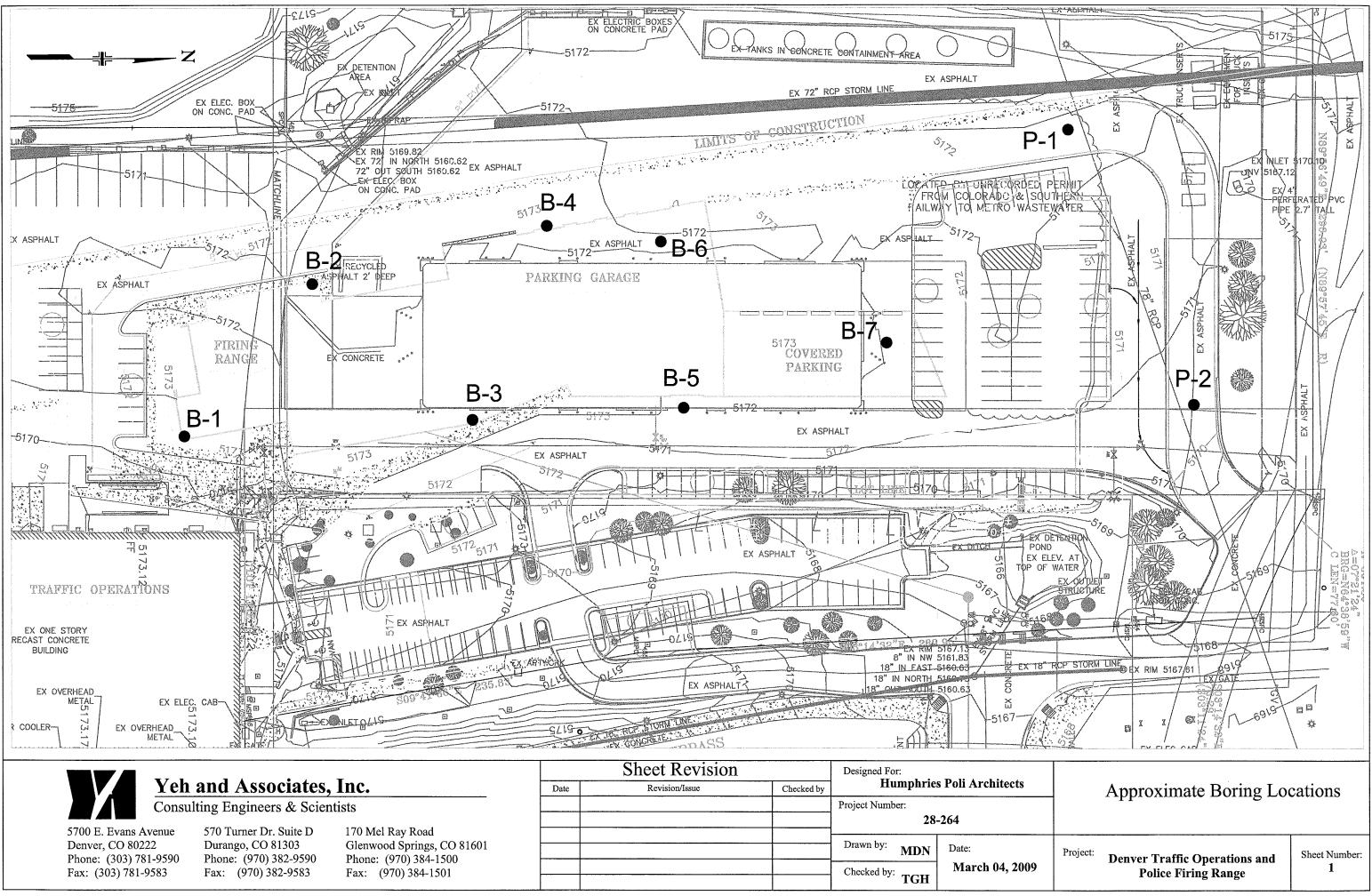
GENERAL COMMENTS

The analyses and recommendations presented in this report are based upon our data obtained from the borings at the indicated locations, field observations, laboratory testing, our understanding of the proposed construction and other information discussed in this report. It is possible that subsurface conditions may vary between or beyond the points explored. The nature and extent of such variations may not become evident until construction. If variations appear, we should be contacted immediately so we can review our report in light of the variations and provide supplemental recommendations as necessary. We should also review the report if the scope of the proposed construction, including the proposed loads, finished elevations or structure locations, change from those described in this report. The conclusions and recommendations contained in this report shall not be considered valid unless Yeh and Associates reviews the changes and either verifies or modifies the conclusions of this report in writing.

The scope of services for this project did not include, specifically or by implication, any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions or biological conditions. If the owner is concerned about the potential for such contamination, conditions or pollution, other studies should be undertaken.

We have prepared this report for the exclusive use of Humphries Poli Architects and the City and County of Denver for a proposed building and parking garage in Denver, Colorado. The report was prepared in substantial accordance with the generally accepted standards of practice for geotechnical engineering as exist in the site area at the time of our investigation. No warranties, express or implied, are intended or made. The recommendations in this report are based on the assumption that Yeh and Associates will conduct an adequate program of construction testing and observation to evaluate compliance with our recommendations.

Adequate testing and observation is essential to successful and economical completion of a construction project. Testing and observation allows us to verify that our recommendations are being followed. They also make it possible to identify varied conditions that require us to modify our recommendations. Construction testing and observation should be scheduled in advance so that our personnel can plan to be available for the work. It is also desirable that we receive a set of project plans and specifications at the time our work is first scheduled.



	Sheet Revision		Designed For:		
Date	Revision/Issue	Checked by	Humphrie	s Poli Architects	
			Project Number:		
			28-264		
			Drawn by: MDN	Date:	
			Checked by: TGH	March 04, 2009	

APPENDIX & Boring Logs

		VE					INC	P	roject: D	enver Traffic &	Firing	Range	Bo	ring: B-1
	ľ	GEO	TECHN	IICAL E	ENGINE	CIATES ERING CONSU	LTANTS	P	roject N	umber: 28-264	Da	ite:	Sh	eet 1 of 1
	Drilling N Drill: CN	Began: 3 Method: ME 55 Rock Ed	Solid		Auger		Drill E Casin Weat	Bit: g: her:	; 3/2/2009		Ground Location	pth: 21.0 ft Elevation: : ates: N: E:		
L	ogged	By: T. H	lanser	٦		Ground Wa	ater Note ⊈							[
	-	: T. Har on: Verf				Depth Date Time		Dry 3/2/0 -		- - -				-
			ype	(%	Rock	Soil San	nples							
	Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	RQD	Blows per 6 in	N	Lithology		Material De	escriptio	on		Field Notes and Lab Tests
						5/8	13		0.2 - 8. 8.0 - 2' cobble	2 ft. Asphalt Paven 0 ft. silty SAND, bla .0 ft. silty SAND so brown - tan, moist subangular to roun	ack, mois ome grav	rel and n dense to	DE #2 LL PL PL S= AA	C= 27.7 % D= 85.7 pcf 00= 47 % = 44 = 31 = 13 = 0.008 % ASHTO: A-7-5 (3) SCS: SM
		10 - - - - 15 -				7/7	29						м	C= 2.5 %
CIATES.GDT 3/26/09						11/15	26							
ASSU		-								Bottom of Hol	le at 21.0) ft.		
BORING LOG 28-264 DEN TRAFFIC.GPJ YEH ASSOCIATES.GDT 3/26/09		- 25 - - - - -												

	YEF GEO	H AN	ID A		CIATES	, INC.		ect: Denver Traffic & Firing Range ect Number: 28-264 Date:	Boring: B-2 Sheet 1 of 1
Drilling Drill: C		Solid		Auger		Comp Drill B Casing Weath	leted: it: g:	/2/2009 Total Depth: 21.0 ft Ground Elevation: Location: Coordinates: N: E:	
	Rock Ed By: T. H		n		Ground Wa	ter Notes	s:		
Final B	y: T. Har ion: Vert	nsen	I		Depth Date Time	<u>V</u>	Dry 3/2/09 -		
		be		Rock	Soil San	nples			
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	RQD	Blows per 6 in	N	Lithology	Material Description	Field Notes and Lab Tests
					10/12 11/10 10/10 8/17	22 21 20 20 25		0.0 - 0.2 ft. Asphalt Pavement. 0.2 - 8.0 ft. clayey SAND, black - brown, moist, stiff. 8.0 - 21.0 ft. silty SAND some gravel and cobble, brown - tan, moist to wet, medium dense to dense, subangular to rounded, fine to coarse grained. Bottom of Hole at 21.0 ft.	MC= 12.5 % DD= 104.7 pcf #200= 21 % LL= 33 PL= 21 PI= 12 AASHTO: A-2-6 (0) USCS: SC MC= 2.1 % DD= 123.1 pcf MC= 3.5 % DD= 109.8 pcf

	YEI			sso	DCIATES	, INC.		-	enver Traffi			Boring: B-3
	GEO	TECHN	ICAL E	NGINE	ERING CONSU	LTANTS	P	Project N	umber: 28-2	64	Date:	Sheet 1 of 1
Drilling Drill: Cl	Began: : Method: ME 55 Rock Ec	Solid-		Auger		Comp Drill B Casin Weatt	Bit: g:	1: 3/2/2009	i	Grou Loca	Depth: 21.0 ft nd Elevation: ion: dinates: N: E:	
	By: T. I		ו		Ground Wa	ter Note	s:					
Final By	y: T. Hai ion: Verl	nsen			Depth Date Time	Ā	Dry 3/2/0 -		- -		- -	
		/pe	(0)	Rock	Soil San	nples						
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	RQD	Blows per 6 in	N	Lithology		Material	Descri	ption	Field Notes and Lab Tests
	-								2 ft. Asphalt Pa) ft. sandy CLA		/lack, moist, stiff.	
	-						/ ///	4.0 - 2	.0 ft. silty SAN ravel and cobb	D to well le. brown	grade SAND, - tan, moist,	
	5 -				6/12	18		🤄 mediur	n dense to den coarse grained.	se, suban	gular to rounded,	MC= 2.4 % DD= 126.8 pcf
												#200= 3 % LL= NV PL= NP PI= NP AASHTO: A-1-a (0) USCS: SW
	-				7/7	14						MC= 1.6 % DD= 124.6 pcf
	15 -		:		10/10	20						
	-											
	20 -							Silt len	ses.		×	
	-				10/21	31			Bottom of	Hole at 2	21.0 ft.	-

		YEI		ID A	SSC	DCIATES	, INC.		-	enver Traffic & Firi	ng Range	Boring: B-4
		GEO	TECHN	IICAL E	NGINE	ERING CONSU	LTANTS	Pr	oject N	umber: 28-264	Date:	Sheet 1 of 1
	Boring E Drilling I Drill: Cl Driller:	Method: ME 55	Solid		Auger		Drill Bi Casing Weath	it: g: ner:	3/2/2009	Grou Loca	l Depth: 21.0 ft ind Elevation: ition: rdinates: N: E:	
	Logged			۱		Ground Wa	ter Notes ⊻				1	
	Final By Inclinati					Depth Date Time		Dry 3/2/09 -	I	-	-	-
	_		[ype	(%	Rock	Soil San	nples	_				
	Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	RQD	Blows per 6 in	N	Lithology		Material Descr	iption	Field Notes and Lab Tests
		-							0.3 - 7.	3 ft. Concrete Pavemen 0 ft. sandy CLAY FILL, rown-gray, moist, stiff.	t	
		-										
		5 -	X			6/5	11					MC= 22 % DD= 95.6 pcf S/C= -0.9 %
		-						<u>X////</u>	tan, mo	I .0 ft. silty SAND with gr bist, medium dense, rou grained.	avels, brown - nded, fine to	
		10				9/9	18					MC= 2 % DD= 112.9 pcf
3/26/09		-				9/10	19					
[ES.GD]		20 -				10/14	26		-			
SOCIAT		-				12/14	26		· · · ·	Bottom of Hole at	21.0 ft.	-
BORING LOG 28-264 DEN TRAFFIC.GPJ YEH ASSOCIATES.GDT 3/26/09												
BORING LO		-									N 1000000000000000000000000000000000000	

•

	V.	YEI GEO				CIATES	, INC. LTANTS		-	enver Traffic & Firi umber: 28-264	ng Range Date:	Boring: B-5 Sheet 1 of 1
	Boring E Drilling M Drill: CM Driller: Logged	Vlethod: ME 55 Rock Ed By: ⊤.⊦	Solid- ge lanser	Stem	Auger	Ground Wa	Drill Bi Casing Weath	leted: it: g: ier:	3/2/2009) Tota Grou Loca	I Depth: 21.0 ft ind Elevation: ition: rdinates: N: E:	
	Final By Inclination					Date Time		3/2/09 -)	-		-
	Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock DD	Soil Sam Blows per 6 in	N	Lithology		Material Descr	iption	Field Notes and Lab Tests
		-							0.2 - 8.	2 ft. Asphalt Pavement. 0 ft. silty SAND to sand d slag, black, moist, de	y CLAY FILL with	
		5				24/13	37		cobble	. 0 ft. silty SAND some brown - tan, moist, me grained.	gravel and dium dense, fine to	MC= 14.7 % DD= 110.8 pcf
		10				13/17	30					MC= 1.5 % S= 0.007 %
GDT 3/26/09		15				7/7	14					
SOCIATES		20 -	\mathbf{X}			9/13	22			Bottom of Hole at	21.0 ft.	_
BORING LOG 28-264 DEN TRAFFIC.GPJ YEH ASSOCIATES.GDT 3/26/09												

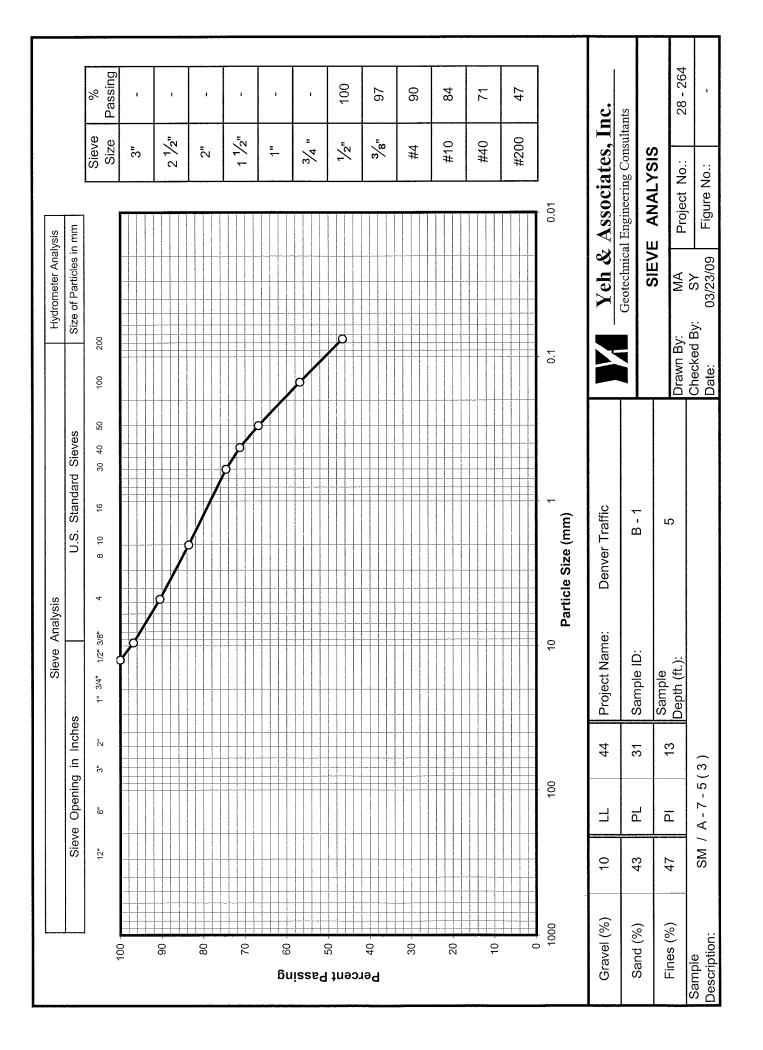
V	YE				DCIATES	, INC.		-	enver Traffic & umber: 28-264	-		Boring: B-6 Sheet 1 of 1
Boring E						Comp	leted:	3/2/2009	· ·	Total Depth	: 21.0 ft	
Drilling I Drill: Cl	Method: ME 55	Solid-		Auger		Drill B Casing Weath	g:			Ground Elev Location: Coordinates		
Driller: Logged			n		Ground Wa	iter Notes	6:					
Final By	/: T. Ha	nsen			Depth Date Time	Ţ	Dry 3/2/09)	-		-	
		e		Rock	Soil San	nples	_		<u>.</u>	<u> </u>		
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	RQD	Blows per 6 in	N	Lithology		Material D	escription		Field Notes and Lab Tests
								0.0 - 0.	3 ft. Asphalt Pave	ment.	· · · · · · · · · · · · · · · · · · ·	/
								0.3 - 8. moist,	0 ft. silty SAND Fl medium dense.	LL with brick,	, black,	
	5 -				11/11	22	 					MC= 15.5 %
								cobble	I.0 ft. silty SAND s , brown - tan, mois d, fine to coarse g	st, medium de	and ense,	DD= 107.9 pcf
					10/11	21						MC= 2.3 % DD= 157.0 pcf
	20 -				10/11	21						
					7/11	18			Bottom of Ho	le at 21 0 ft		_
										,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
	-											

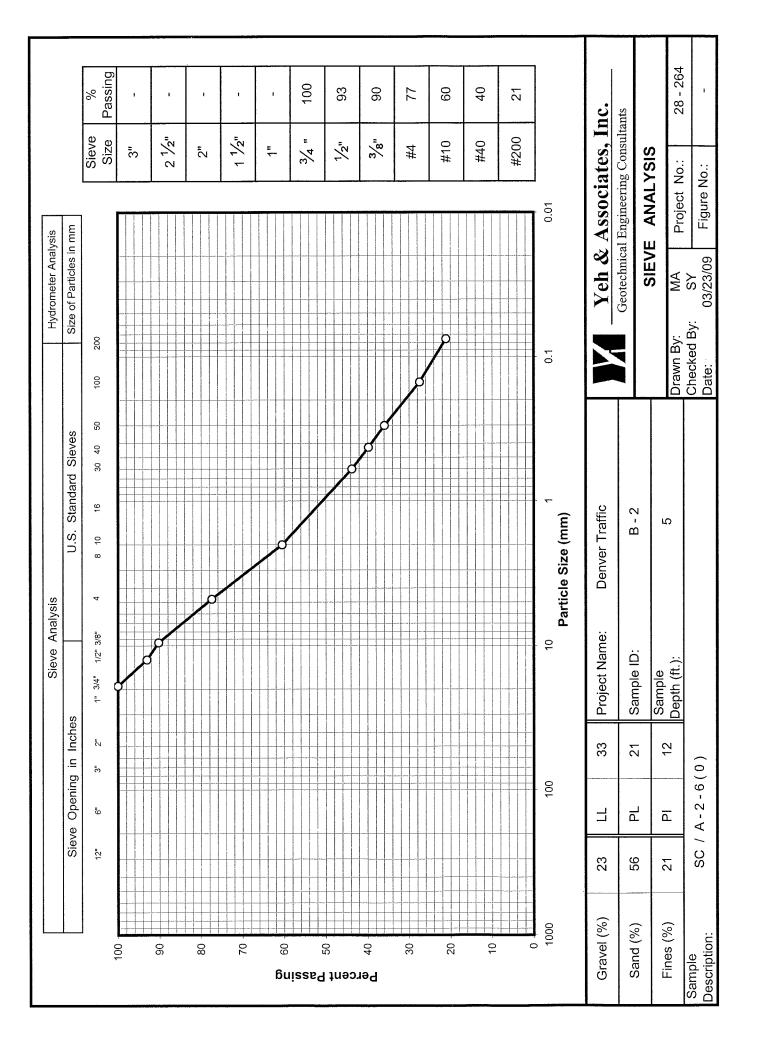
K	YE GEO	H AN DTECHN	ND A		DCIATES ERING CONSU	, INC. LTANTS		•	Denver Traffic & Firi umber: 28-264	ng Range Date:	Boring: B-7 Sheet 1 of 1
Drilling Drill:	Began: 9 Method CME 55 1 Rock E	: Solid		Auger	-	Comp Drill B Casin Weatl	sit: g:	3/2/200	Grou Loca	l Depth: 21.0 ft und Elevation: ation: rdinates: N: E:	I
	d By: T.		n		Ground Wa		s:		,		
	By: T.Ha Ition: Ve				Depth Date Time	Ţ	Dry 3/2/09 -)			-
L L		Type	(%)	Rock	Soil San	nples	۲ ک				
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	RQD	Blows per 6 in	N	Lithology		Material Descr	iption	Field Notes and Lab Tests
	5 10 15 20 25				17/11 5/10 8/8 8/7	28 15 16 15		0.3 - 8 brick a stiff. 8.0 - 1 moist, 12.5 - tan, m	3 ft. Concrete Pavemen 0 ft. sandy CLAY to silt nd slag, black - brown, r 2.5 ft. silty SAND, brown medium dense. 21.0 ft. silty SAND with g oist, medium dense, rou grained. Bottom of Hole at 1	y SAND FILL with noist, stiff to very	MC= 18.4 % DD= 82.8 pcf MC= 8.8 % #200= 18 % LL= NV PL= NP PI= NP AASHTO: A-1-b (0) USCS: SM MC= 3.6 % DD= 109.2 pcf

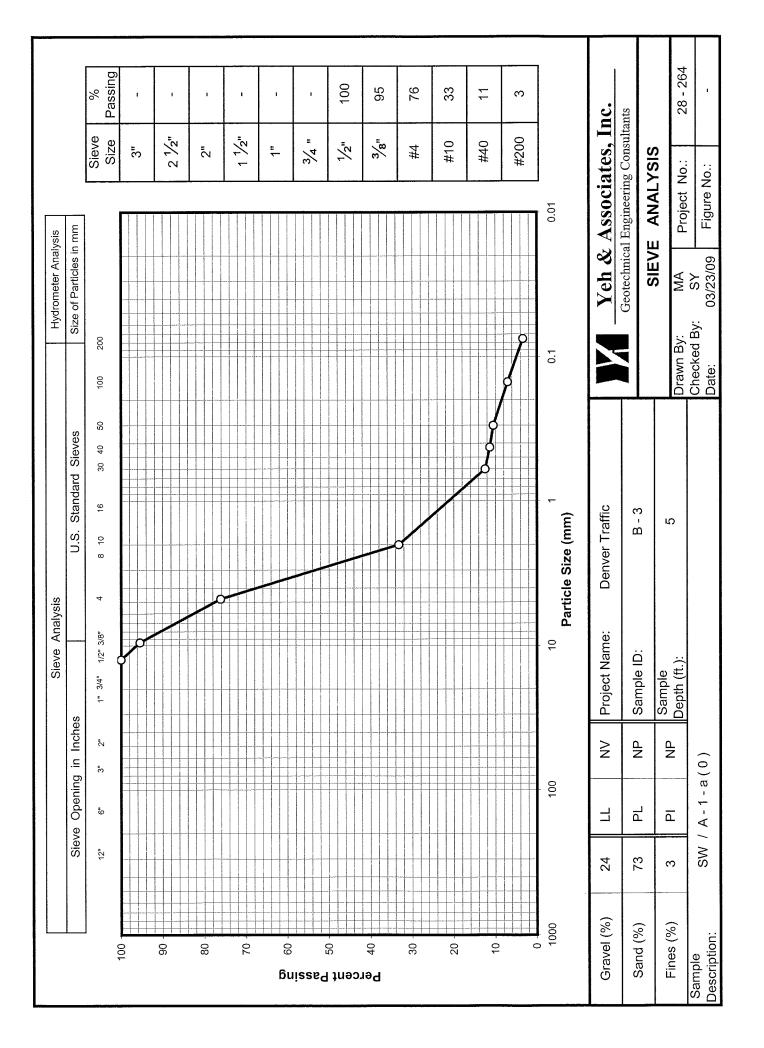
	GEO	H AN	ID A ICAL E		DCIATES, ERING CONSUL	INC. TANTS		-	umber: 28		ng Range Date:		ing: P-1 eet 1 of 1
Drilling Drill: C		Solid-		Auger		Comp Drill E Casin Weat	Bit: g:	3/2/2009)	Grou Loca	Depth: 6.0 ft nd Elevation: tion: dinates: N: E:		
	Rock Ed By: T. F		_		Ground Wat	er Note	s:						
Final By	v: T. Har on: Vert	isen	1			Ā	Dry 3/2/09 -		-		-		- - -
		be		Rock	Soil Sam	ples					<u> </u>		
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	RQD	Blows per 6 in	N	Lithology		Mater	ial Descri	ption		Field Notes and Lab Tests
					8/12	20		brick, b	ılack, moist, um odor.	d Asphalt F medium der	ILL with clay and nse, subangular, 6.0 ft.	#20 LL= PL: PI= S=	2= 12.3 % 00= 26 % = 33 = 21 : 12 0.057 % SHTO: A-2-6 (0) CS: SC

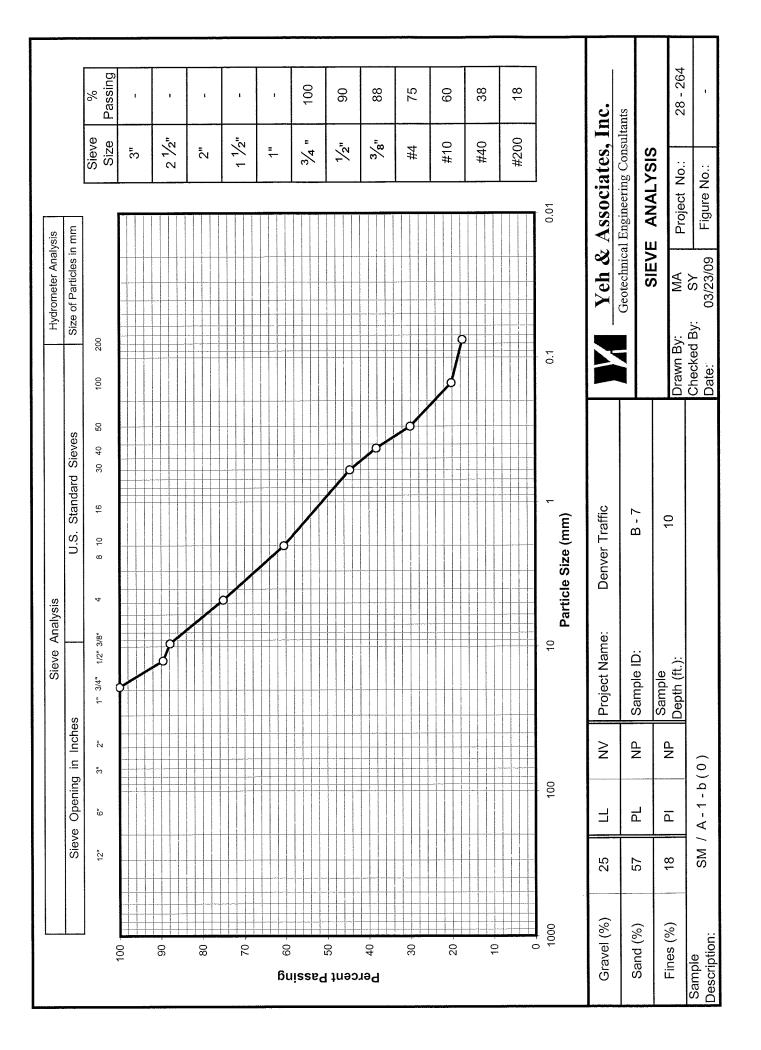
		YEH			sso		INC	P	roject: [enver Traffic	& Firiı	ng Range	Во	ring: P-2
		GEOT	TECHN	ICAL E	ENGINE	DCIATES ERING CONSL	LTANTS	P	roject N	umber: 28-26	4	Date:	She	eet 1 of 1
	Boring E Drilling M Drill: CM	Viethod: VIE 55	Solid-		Auger		Comp Drill E Casin Weat	Bit: ng:	: 3/2/2009)	Grou Loca	Depth: 6.0 ft nd Elevation: tion: dinates: N: E:	1	
	Driller: I			h		Ground Wa	ater Note	s:						
	Final By	: T. Han	isen			Depth Date	Ā	Dry 3/2/0		-		-		-
	Inclinatio	on: Verti	ical			Time		-		-		-		-
1	_		ype	(%	Rock	Soil Sar	nples	-						
	Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	RQD	Blows per 6 in	N	Lithology		Material I	Descri	ption		Field Notes and Lab Tests
			Ъ						0.0 - 6.	0 ft. sandy CLAY o moist, stiff.	r, black	- dark brown,		
BORING LOG 28-264 DEN TRAFFIC.GPJ YEH ASSOCIATES.GDT 3/26/09						4/5	9			Bottom of	Hole at	6.0 ft.	H2 LL PL PI= AA	C= 9.7 % 00= 26 % = 31 = 18 = 13 SHTO: A-2-6 (0) SCS: SC
30RING LOG 28-264 DEN														

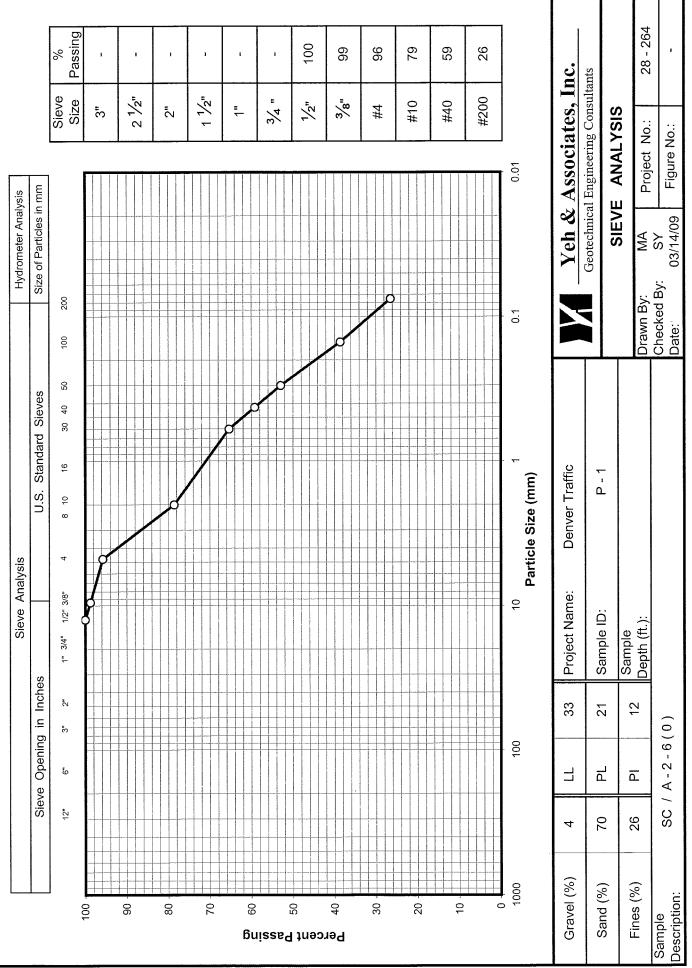
APPENDIX B- Laboratory Test Results

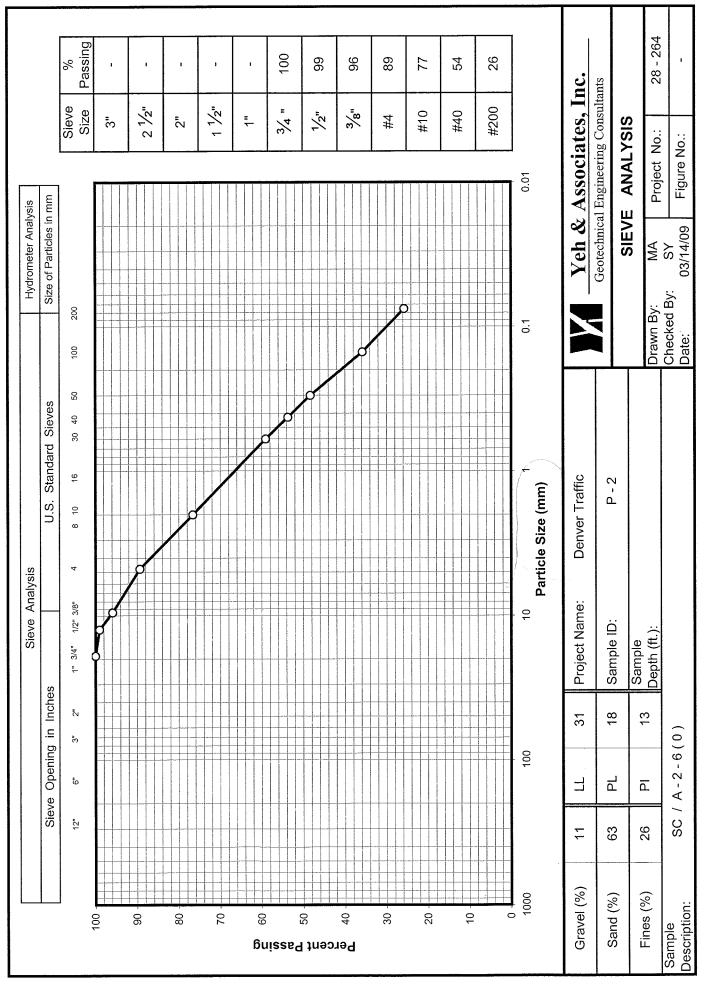












YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

3//14/09	ATION	nscs	SM	-	sc	I		SW	1	I		I	1	l	Ι	1	SM	-
Date:	CLASSIFICATION	AASHTO	A-7-5 (3)	I	A-2-6 (0)	I	1	A-1-a (0)		I		I	I		1		A-1-b (0)	-
		R-VALUE	I		l	ł	1	1		1	ł	1	I	I	I	l	Ι	
	Unconf.	Strength (psf)	1	I	I	I	l	I	ļ	I		ł			-	I		ļ
perations	% Swell (+) /	Consoli- dation (-)	1	I	I		I	ŀ	-	-0.9	I	a	I	I	-	I	I	ĩ
Denver Traffic Operations	Water %	Sulfate %	0.008	Ι	-	1		l		I	I	l	0.007	1		1	I	1
envel		Hd	1	1	I	I	I	I	1	1	I	I	ļ	1	l	I	I	I
		Ē	13	I	12	I	I	NP	I	1	1	I	ļ	I	I	I	ЧN	I
	Atterberg	Ч	31	I	21	1	I	NP	I		1	1	. 1	1	1	1	ЧN	1
	- Ati		44	1	33		1	NV	1	1			1		1	I	N	1
	/ Lioo	#200 (%)	47	1	21	1	I	3	1	Ι		I		I	1	a na	18	1
Name:	Gradation	Sand (%)	43		56	1	Ι	73	I		-	Ι	1	l	-	I	57	
Project Name:	[cross]	(%)	10	1	23	I	I	24	I	1	I	ł	l	1	I	I	25	1
	Natural Dry	Density (pcf)	85.7	÷	104.7	123.1	109.8	126.8	124.6	92.6	112.9	110.8	l	107.9	157.0	82.8	I	109.2
28 - 264	Natural	Content (%)	27.7	2.5	12.5	2.1	3.5	2.4	1.6	22.0	2.0	14.7	1.5	15.5	2.3	18.4	8.8	3.6
- 28 -	tion	Sample Type	CA	CA	CA	CA	CA	CA	CA	CA	CA	CA	CA	CA	CA	CA	CA	CA
ס	Sample Location	Depth (ft)	5	10	£	10	15	5	10	5	10	5	10	5	10	5	10	15
Project No:	Sa	Boring NO.	B - 1	B - 1	B - 2	B - 2	B - 2	B-3	В-3	B - 4	B - 4	B - 5	B - 5	B - 6	B - 6	B - 7	B - 7	B - 7

YA YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

3//14/09	ATION	NSCS	sc	sc	4								
Date:	CLASSIFICATION	AASHTO	A-2-6 (0)	A-2-6 (0)									
		R-VALUE	-										
		Comp. Strength (psf)	I	Ι									
Denver Traffic Operations	6 Swell (+) /	Consoli- dation (-)	I	I							- -		*
Traffic O	Water 9	Soluble Sulfate %	0.057	J									
enver		Hd		1						 			
ă		đ	12	13						 			
	Atterberg	2	21	18									
	Atto		33	31									
		Fines < #200 (%)		26							 		
	U												
Name	Gradation	Sand (%)	20	63		:							
Project Name:		Gravel > #4 (%)	4	1					-				
	Natural Drv	Density (pcf)		i.									×
28 - 264	Natural	Moisture Content (%)	12.3	9.7									
- 28 -	tion	Sample Type	Bulk	Bulk									
40:	Sample Location	Depth (ft)	0-5	0-5									
Project No:	Sa	Boring NO.	P - 1	P - 2			-						

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

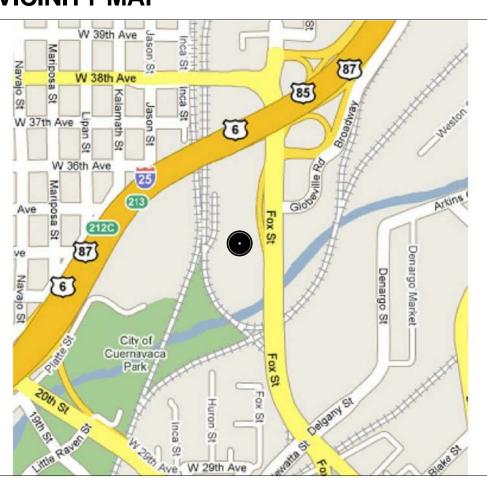
- A. Alternate No. 01: Evidence Cage at Existing Vehicle Storage
 - 1. Base Bid: No work associated with addition of Vehicle Cage 143
 - 2. Alternate: Provide new vehicle cage as depicted in the Bid Documents, including plumbing, electrical, structural, and door modifications and additions.
- B. Alternate No. 02: Insulation and Heating at Existing Vehicle Storage Walls and Roof
 - 1. Base Bid: No work associated with the addition of insulation or heating at the Existing Vehicle Storage walls or roof.
 - 2. Alternate: Add Insulation and heating as shown in the Bid Documents for Existing Vehicle Storage
- C. Alternate No. 3: Install skid-resistant epoxy floor sealer at new garage interior
 - 1. Base Bid: Finish concrete per Concrete specifications.
 - 2. Alternate: All work related to the addition of epoxy floor sealer at new garage interior.
- D. Alternate No. 04: Install Bus Duct
 - 1. Base Bid: Install 400A panel per the Bid Documents
 - 2. Alternate: Eliminate the 400A panel and install bus duct per the Bid Documents.
- E. Alternate No. 05: Provide Solatube Skylights
 - 1. Base Bid: No work associated with skylights
 - 2. Alternate: Provide Solatube Skylights and all associated work per the Bid Documents.
- F. Alternate No. 06: Paint all overhead structure and interior exposed concrete walls and columns.
 - 1. Base Bid: All overhead structure to be primed and interior exposed concrete walls to be finished per associated Concrete and Metals specifications
 - 2. Alternate: Paint all overhead structure and interior exposed concrete walls and columns.
- G. Alternate No. 07: Install interior loops for garage doors
 - 1. Base Bid: No work associated with vehicle loops.
 - 2. Alternate: Install interior loops for garage doors

A/C	AIR CONDITIONING	GAL	G
AB	ANCHOR BOLT	GALV	G
ACOUST	ACOUSTICAL	GA	G
ACT	ACOUSTICAL CEILING TILE	GC	G
\DDL	ADDITIONAL	GEN	G
\DJ	ADJACENT / ADJUSTABLE	G.I.	G
\FF	ABOVE FINISH FLOOR	GL	G
\LT	ALTERNATE	GR	G
lum Nod	ALUMINUM ANODIZED	GYP	G
PPROX	APPROXIMATE	H	H
RCH		HB	H
SSY	ASSEMBLY	HC	H.
UTO	AUTOMATIC	HDBD	H.
UX	AUXILIARY	HDR	Н
/V	AUDIO - VISUAL	HDWR	H.
VG	AVERAGE	HDWD	H.
D	BOARD	HGT HM	H H
ITUM	BITUMINOUS	HORIZ	H
LDG	BUILDING	HP	H
BLKG	BLOCKING	HR	H
BM	BEAM	HVAC	H
.0.	BOTTOM OF		A
OT .O.W.	BOTTOM BOTTOM OF WALL	HW	H
RG	BEARING	IBC	IN
SMT	BASEMENT	ID	IN
TWN	BETWEEN	IN	IN
.U.R.	BUILT-UP ROOF	INCAND	IN
AB	CABINET	INCL INFO	IN IN
В	CHALKBOARD	INSUL	IN IN
ER FCI	CONTRACTOR FURNISHED /	INT INV	IN
FOI	CONTRACTOR INSTALLED CONTRACTOR FURNISHED /	IRRIG	IR
ļ	OWNER INSTALLED	JAN	/J
	CAST IRON	JT	J(
IP J	CAST IN PLACE CONTROL JOINT	KIT.	KI
L	CENTER LINE		
LG	CEILING	L	LC
LR	CLEAR		L/
:MU	CONCRETE MASONRY UNIT	LAM	L/
:OL	COLUMN	LAV	L/
ONC	CONCRETE	LB	P(
ONN	CONNECTION	LDR	LE
ONST	CONSTRUCTION (CONSTRUCT)	LF	LI
ONT	CONTINUOUS	LH	
ONTR COORD	CONTRACTOR COORDINATE	LHR	LE
PT	CARPET	LLV	LC
CT	CERAMIC TILE	LP	L(
CTR	CENTER	LTWT	LI
:TSK :U	COUNTERSINK (COUNTERSUNK) CUBIC	LVL	LE
W	CABINET UNIT HEATER	MAINT	М
W	COLD WATER	MAS	М
:.Y.	CUBIC YARD	MATL MAX	M
	DEEP	MECH	М
BL	DOUBLE	MED	M
EMO	DEMOLITION / DEMOLISH	MEM	M
EPT	DEPARTMENT	MEZZ	MM
ITL	DETAIL	MFR	
F	DRINKING FOUNTAIN	MIN	M
IA	DIAMETER	MISC	M
DIAG	DIAGONAL DIMENSION	MLD	M
DIM.		MLWK	M
ISP	DISPENSER / DISPOSAL	MO	M
N	DOWN	MTD	
R	DOOR	MTL	М
S	DOWN SPOUT	MTG	M
W	DISHWASHER	MULL	M
WG	DRAWING	MULT	M
E) / EXG	EAST	N	N
	EXISTING	N/A	N
A	EACH	NEG	NI
F	EXHAUST FAN	NFPA	N/
IFS	EXTERIOR INSULAT. FINISH SYSTEM	N.I.C.	N(
J	EXPANSION JOINT	NO	
L	ELEVATION	NOM	N
LEC	ELECTRICAL	NRC	N
LEV	ELEVATOR	NTS	
MER NAM	EMERGENCY ENAMEL	OC	0
NCL	ENCLOSURE	OD	0
NGR	ENGINEER	OFCI	0'
Q	EQUAL	OFOI	C(
QUIP	EQUIPMENT		0'
SMT	EASEMENT	ОН	'0
ST	ESTIMATE (D)		'0
/W	EACH WAY	OPH	0
WC	ELECTRIC WATER COOLER	OPNG	0
XH	EXHAUST	OPP	0
XP	EXPANSION	ord	0
XT	EXTERIOR	Orig	0
.A.	FIRE ALARM	PA	P
AB	FABRICATE(D)	PART BD	P/
BO	FINISHED BY OTHERS	PC	Pl
.C. .D.	FACE OF CURB	PERIM	PI
DTN	FOUNDATION	P.L.	PI
E	FIRE EXTINGUISHER	PL	PI
.E.C.	FIRE EXTINGUISHER CABINET	PLAM	PI
F	FINISH FLOOR	PLAS	PI
.H.	FLAT HEAD	PLBG	PI
Ή	FIRE HYDRANT	PLYWD	Pl
IN	FINISH(ED)	PNL	P/
IXT	FIXTURE	PORC	P(
LASH	FLASHING	PR	P/
LEX	FLEXIBLE FLOOR	PREFAB	PI
LUOR		PREP	PI PI
0	FINISHED OPENING	PROP	PI
.O.C.	FACE OF CONCRETE	PSF	P(
.O.F.	FACE OF FINISH	PSI	
.O.M.	FACE OF MASONRY	PT	P/
.O.S.	FACE OF STUD	PVC	P(
P	FIREPROOF(ING)	PVMT	P/
R	FRAME / FIRE RESISTANT / RATED	PWR	P(
RP	FIBERGLASS REINFORCED PLASTIC	QTY	
T	FOOT / FEET		Q
TG	FOOTING	QT	Q
URN VC	FURNITURE FIRE VALVE CABINET		

	GALLON(S) GALVANIZED GAGE	R R.A. RCP	RADIUS RETURN AIR REFLECTED CEILING PLAN
	GENERAL CONTRACTOR	R.D.	ROOF DRAIN
	GENERAL / GENERATOR GALVANIZED IRON	RE: REBAR	REFER TO / REFERENCE REINFORCING BAR
	GLASS GRADE	REC REF	RECESS(ED) REFRIGERATOR
	GYPSUM	REG REINF	REGISTER / REGULAR REINFORCE(ED)(ING)
	HIGH	REM	REMOVE
	HOSE BIB HANDICAP, HOLLOW CORE	RESIL REQ	RESILIENT REQUIREMENTS / REQUIRED
	HARD BOARD HEADER	REV RFG	REVISION / REVISE(ED) ROOFING
	HARDWARE	RH RHR	RIGHT HAND
	HARDWOOD HEIGHT	RHR RM	RIGHT HAND REVERSE ROOM
	HOLLOW METAL HORIZONTAL	R.O. R.O.W.	ROUGH OPENING RIGHT OF WAY
	HIGH POINT HOUR	R/S	ROUGH SAWN
	HEATING VENTILATING AND	S	SOUTH
	AIR CONDITIONING HOT WATER	S.A. SAG	SUPPLY AIR SUSPENDED ACOUSTICAL GRID
	INTERNATIONAL BUILDING CODE	SAN SC	SANITARY SOLID CORE
	INSIDE DIAMETER INCH	SCHED SEC	SCHEDULE SECOND
D	INCANDESCENT	SECT	SECTION
	INCLUDE(D) INFORMATION	SF SHT	SQUARE FEET SHEET
	INSULATION INTERIOR	SIM SM	SIMILAR SHEET METAL / SMALL
	INVERT	SS	STAINLESS STEEL
	IRRIGATION	SHWR SPEC	SHOWER SPECIFICATION
	JANITOR JOINT	SPKLR SQ	SPRINKLER SQUARE
	KITCHEN	ST STA	STAIN, STREET STATION
		STC	SOUND TRANSMISSION CLASS
	LOW LABORATORY	STD STL	STANDARD STEEL
	LAMINATE LAVATORY	STOR STRUCT	STORAGE STRUCTURE(AL)
	POUND	SUSP	SUSPEND(ED)(SION)
	LEADER LINEAR FEET	SV S.Y.	SHEET VINYL SQUARE YARD
	LEFT HAND LEFT HAND REVERSE	SYN SYS	SYNTHETIC SYSTEM
	LONG LEG HORIZONTAL LONG LEG VERTICAL	Т	
	LOW POINT	T&B	TREAD(S) TOP AND BOTTOM
	LIGHTWEIGHT LEVEL	TB TBD	TACKBOARD TO BE DETERMINED
	MAINTENANCE	T.C. TEL	TOP OF CURB TELEPHONE
	MASONRY	TEMP	TEMPERATURE / TEMPORARY
	MATERIAL MAXIMUM	T&G THK	TONGUE AND GROOVE THICK(NESS)
	MECHANICAL MEDIUM	T.O. T.O.C.	TOP OF TOP OF CONCRETE
	MEMBRANE	T.O.F.	TOP OF FRAMING
	MEZZANINE MANUFACTURER(ED)	T.O.S. T.O.W.	TOP OF STEEL / STUD TOP OF WALL
	MINIMUM, MINUTE MISCELLANEOUS	TRANSF TS	TRANSFORMER TUBE STEEL
	MOULDING MILLWORK	TV TYP	TELEVISION TYPICAL
	MASONRY OPENING		
	MOUNT(ED) METAL	UBC UL	UNIFORM BUILDING CODE UNDERWRITERS LABORATORIES
	MOUNTING MULLION	UNO UON	UNLESS NOTED OTHERWISE UNLESS OTHERWISE NOTED
	MULTIPLE	UTIL	UTILITIES
			VAPOR BARRIER
	NORTH	V.B.	
	NORTH NOT APPLICABLE NEGATIVE	V.B. VCT VERT	VINYL COMPOSITION TILE VERTICAL
	NOT APPLICABLE NEGATIVE NATIONAL FIRE PROTECTION AGENCY	VCT VERT VIF	VERTICAL VERIFY IN FIELD
	NOT APPLICABLE NEGATIVE NATIONAL FIRE PROTECTION AGENCY NOT IN CONTRACT NUMBER	VCT VERT	VERTICAL
	NOT APPLICABLE NEGATIVE NATIONAL FIRE PROTECTION AGENCY NOT IN CONTRACT	VCT VERT VIF VTR	VERTICAL VERIFY IN FIELD VENT-THRU ROOF
	NOT APPLICABLE NEGATIVE NATIONAL FIRE PROTECTION AGENCY NOT IN CONTRACT NUMBER NOMINAL	VCT VERT VIF VTR VWC	VERTICAL VERIFY IN FIELD VENT-THRU ROOF VINYL WALL COVERING
	NOT APPLICABLE NEGATIVE NATIONAL FIRE PROTECTION AGENCY NOT IN CONTRACT NUMBER NOMINAL NOISE REDUCTION COEFFICIENT NOT TO SCALE ON CENTER	VCT VERT VIF VTR VWC W (W) W.C. WD	VERTICAL VERIFY IN FIELD VENT-THRU ROOF VINYL WALL COVERING WEST WIDE WATER CLOSET WASHER / DRYER COMBO
	NOT APPLICABLE NEGATIVE NATIONAL FIRE PROTECTION AGENCY NOT IN CONTRACT NUMBER NOMINAL NOISE REDUCTION COEFFICIENT NOT TO SCALE ON CENTER OUTSIDE DIAMETER / DIMENSION OWNER FURNISHED /	VCT VERT VIF VTR VWC W (W) W.C. WD WDW WH	VERTICAL VERIFY IN FIELD VENT-THRU ROOF VINYL WALL COVERING WEST WIDE WATER CLOSET WASHER / DRYER COMBO WINDOW WATER HEATER
	NOT APPLICABLE NEGATIVE NATIONAL FIRE PROTECTION AGENCY NOT IN CONTRACT NUMBER NOMINAL NOISE REDUCTION COEFFICIENT NOT TO SCALE ON CENTER OUTSIDE DIAMETER / DIMENSION	VCT VERT VIF VTR VWC W (W) W.C. WD WDW	VERTICAL VERIFY IN FIELD VENT-THRU ROOF VINYL WALL COVERING WEST WIDE WATER CLOSET WASHER / DRYER COMBO WINDOW
	NOT APPLICABLE NEGATIVE NATIONAL FIRE PROTECTION AGENCY NOT IN CONTRACT NUMBER NOMINAL NOISE REDUCTION COEFFICIENT NOT TO SCALE ON CENTER OUTSIDE DIAMETER / DIMENSION OWNER FURNISHED / CONTRACTOR INSTALLED OWNER INSTALLED	VCT VERT VIF VTR VWC W (W) W.C. WD WDW WH WH W.R. WWF W/	VERTICAL VERIFY IN FIELD VENT-THRU ROOF VINYL WALL COVERING WEST WIDE WATER CLOSET WASHER / DRYER COMBO WINDOW WATER HEATER WATER RESISTANT WELDED WIRE FABRIC WITH
	NOT APPLICABLE NEGATIVE NATIONAL FIRE PROTECTION AGENCY NOT IN CONTRACT NUMBER NOMINAL NOISE REDUCTION COEFFICIENT NOT TO SCALE ON CENTER OUTSIDE DIAMETER / DIMENSION OWNER FURNISHED / CONTRACTOR INSTALLED OWNER FURNISHED / OWNER FURNISHED / OWNER INSTALLED OVERHEAD, OVERHANG OPPOSITE HAND	VCT VERT VIF VTR VWC W (W) W.C. WD WDW WH WA WH W.R. WWF W/ W/I W/O	VERTICAL VERIFY IN FIELD VENT-THRU ROOF VINYL WALL COVERING WEST WIDE WATER CLOSET WASHER / DRYER COMBO WINDOW WATER HEATER WATER RESISTANT WELDED WIRE FABRIC WITH WITHIN WITHOUT
	NOT APPLICABLE NEGATIVE NATIONAL FIRE PROTECTION AGENCY NOT IN CONTRACT NUMBER NOMINAL NOISE REDUCTION COEFFICIENT NOT TO SCALE ON CENTER OUTSIDE DIAMETER / DIMENSION OWNER FURNISHED / CONTRACTOR INSTALLED OWNER FURNISHED / OWNER INSTALLED OVERHEAD, OVERHANG	VCT VERT VIF VTR VWC W (W) W.C. WD WDW WH WH WR. WWF W/ W/I	VERTICAL VERIFY IN FIELD VENT-THRU ROOF VINYL WALL COVERING WEST WIDE WATER CLOSET WASHER / DRYER COMBO WINDOW WATER HEATER WATER RESISTANT WELDED WIRE FABRIC WITH WITHIN WITHOUT WOOD
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	NOT APPLICABLE NEGATIVE NATIONAL FIRE PROTECTION AGENCY NOT IN CONTRACT NUMBER NOMINAL NOISE REDUCTION COEFFICIENT NOT TO SCALE ON CENTER OUTSIDE DIAMETER / DIMENSION OWNER FURNISHED / CONTRACTOR INSTALLED OWNER FURNISHED / OWNER INSTALLED OVERHEAD, OVERHANG OPPOSITE HAND OPENING OPPOSITE OVERFLOW ROOF DRAIN ORIGINAL	VCT VERT VIF VTR VWC W (W) WC. WD WDW WH WR. WWF W/ W/I W/O WD WP WGT	VERTICAL VERIFY IN FIELD VENT-THRU ROOF VINYL WALL COVERING WEST WIDE WATER CLOSET WASHER / DRYER COMBO WINDOW WATER HEATER WATER RESISTANT WELDED WIRE FABRIC WITH WITHIN WITHOUT WOOD WEATHERPROOF, WORKING POI WEIGHT YARD
3D	NOT APPLICABLENEGATIVENATIONAL FIRE PROTECTION AGENCYNOT IN CONTRACTNUMBERNOMINALNOISE REDUCTION COEFFICIENTNOT TO SCALEON CENTEROUTSIDE DIAMETER / DIMENSIONOWNER FURNISHED /CONTRACTOR INSTALLEDOWNER FURNISHED /OWNER FURNISHED /OVERHEAD, OVERHANGOPPOSITE HANDOPPOSITEOVERFLOW ROOF DRAINORIGINALPUBLIC ADDRESSPARTICLE BOARD	VCT VERT VIF VTR VWC W (W) W.C. WD WDW WH W.R. WWF W/ W/I W/O WD WD WP WGT	VERTICAL VERIFY IN FIELD VENT-THRU ROOF VINYL WALL COVERING WEST WIDE WATER CLOSET WASHER / DRYER COMBO WINDOW WATER HEATER WATER RESISTANT WELDED WIRE FABRIC WITH WITHIN WITHOUT WOOD WEATHERPROOF, WORKING POI WEIGHT
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) B	NOT APPLICABLENEGATIVENATIONAL FIRE PROTECTION AGENCYNOT IN CONTRACTNUMBERNOMINALNOISE REDUCTION COEFFICIENTNOT TO SCALEON CENTEROUTSIDE DIAMETER / DIMENSIONOWNER FURNISHED /CONTRACTOR INSTALLEDOWNER FURNISHED /OWNER FURNISHED /OWNER FURNISHED /OWNER FURNISHED /OVERHEAD, OVERHANGOPPOSITE HANDOPPOSITE HANDOPENINGOPPOSITEOVERFLOW ROOF DRAINORIGINALPUBLIC ADDRESSPARTICLE BOARDPRECASTPERIMETERPERPENDICULARPROPERTY LINEPLATEPLASTIC LAMINATEPLASTIC / PLASTERPLUMBLINGPLYWOODPANELPORCELAINPAIRPREFABRICATE(D)PREFINISH(ED)PREPARATION / PREPARE	VCT VERT VIF VTR VWC W W W W W W W W W W W W W	VERTICAL VERIFY IN FIELD VENT-THRU ROOF VINYL WALL COVERING WEST WIDE WATER CLOSET WASHER / DRYER COMBO WINDOW WATER HEATER WATER RESISTANT WELDED WIRE FABRIC WITH WITHIN WITHOUT WOOD WEATHERPROOF, WORKING POI WEIGHT YARD YEAR AND AND ANGLE AT BY / MULTIPLY CENTERLINE DEGREE DIAMETER DIVIDE FEET
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) B	NOT APPLICABLE NEGATIVE NEGATIVE NATIONAL FIRE PROTECTION AGENCY NOT IN CONTRACT NUMBER NOMINAL NOISE REDUCTION COEFFICIENT NOT TO SCALE ON CENTER OUTSIDE DIAMETER / DIMENSION OWNER FURNISHED / CONTRACTOR INSTALLED OWNER FURNISHED / CONTRACTOR INSTALLED OVERHEAD, OVERHANG OPPOSITE HAND OPENING OPPOSITE OVERHANG OPPOSITE OVERFLOW ROOF DRAIN ORIGINAL PUBLIC ADDRESS PARTICLE BOARD PRECAST PERIMETER PERPENDICULAR PROPERTY LINE PLATE PLASTIC / PLASTER PLUMBLING PLYWOOD PANEL PORCELAIN PAIR PROPERTY POUNDS PER SQUARE FEET POUNDS PER SQUARE INCH PAINT, POINT, PRESSURE TREATED POLYVINYL CHLORIDE PAVEMENT	VCT VERT VIF VTR VWC W W W W W WD WD WF W/ W/I W/O WD WP WGT YD YR YD YR	VERTICAL VERIFY IN FIELD VENT-THRU ROOF VINYL WALL COVERING WEST WIDE WATER CLOSET WASHER / DRYER COMBO WINDOW WATER HEATER WATER RESISTANT WELDED WIRE FABRIC WITH WITHOUT WOOD WEATHERPROOF, WORKING POI WEIGHT YARD YEAR YARD YEAR AND ANGLE AT BY / MULTIPLY CENTERLINE DEGREE DIAMETER DIVIDE FEET GREATER THAN GREATER THAN GREATER THAN GREATER THAN GREATER THAN CENTERLINE DEGREE DIAMETER DIVIDE FEET GREATER THAN OR EQUAL TO INCHES LESS THAN LESS THAN OR EQUAL TO NUMBER / POUND PERCENT
) B	NOT APPLICABLE NEGATIVE NEGATIVE NATIONAL FIRE PROTECTION AGENCY NOT IN CONTRACT NUMBER NOMINAL NOISE REDUCTION COEFFICIENT NOT TO SCALE ON CENTER OUTSIDE DIAMETER / DIMENSION OWNER FURNISHED / CONTRACTOR INSTALLED OWNER FURNISHED / CONTRACTOR INSTALLED OVERHEAD, OVERHANG OPPOSITE OVERHEAD, OVERHANG OPPOSITE OVERFLOW ROOF DRAIN ORIGINAL PUBLIC ADDRESS PARTICLE BOARD PRECAST PERIMETER PERPENDICULAR PROPERTY LINE PLATE PLASTIC / PLASTER PLUMBLING PLYWOOD PANEL PORCELAIN PAIR PREFABRICATE(D) PREPARATION / PREPARE PROJECT PAVEMENT POWER	VCT VERT VIF VTR VWC W W W W WD WD WD WF W/ W/ W/ W/ W/ W/ W/ W/ W/ W/	VERTICAL VERIFY IN FIELD VENT-THRU ROOF VINYL WALL COVERING WEST WIDE WATER CLOSET WASHER / DRYER COMBO WINDOW WATER HEATER WATER RESISTANT WELDED WIRE FABRIC WITH WITHIN WITHOUT WOOD WEATHERPROOF, WORKING POI WEIGHT YARD YEAR YARD YEAR AND AND ANGLE AT BY / MULTIPLY CENTERLINE DEGREE DIAMETER DIVIDE FEET GREATER THAN OR EQUAL TO INCHES LESS THAN LESS THAN OR EQUAL TO NUMBER / POUND
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	MATERIAL L	EGEND	ARCHITECT	URAL SY	MBOLS
	PLAN AND SEC	TION	View	/ Name	Drawing Title
ING PLAN			1/8" = 1'-	ס"	Scale
		EARTH, UNDISTURBED			Building Section
RENCE R			SIM		 Direction of Sight Drawing Number
	LE CE CE CE CE LE CE CE CE CE	GRAVEL	A10	_	 Sheet Number
_AR					Wall Section
IG)		CONCRETE, CAST IN PLACE, PRECAST	P SIM		 Direction of Sight Drawing Number
REQUIRED			A101	=	 Sheet Number
(ED)		BRICK			Detail Cut
			■ SIM		 Direction of Sight Drawing Number
RSE		CONCRETE MASONRY UNIT (CMU)	A10		 Sheet Number
			SIM		
		STONE			Detail Calley It
				·	Detail Callout
STICAL GRID		WOOD (ROUGH)		j	
					Exterior Elevation
		WOOD (ROUGH) BLOCKING OR SHIM			 Direction of Sight Drawing Number
			A10 9		Sheet Number
		WOOD (FINISH)			
					Interior Elevation — Direction of Sight
ALL.		SAND, PLASTER, MORTAR, GROUT	2 (A101)	1	 Drawing Number Sheet Number
		METAL, STRUCTURAL STEEL STUDS		_	
			0.00	0.0	Column Centerline
		RIGID INSULATION		\bigvee	Reference Grid & Bubble
ION CLASS					
		BATT, LOOSE-FILL INSULATION			
				0.0	
<u>)</u>					
	ELEVATION			,	
				Room name	Room Tag — Room Name
		MASONRY		888 150 SE	 Room Number
					 Square Footage
)		SIDING		1 i	Partition or Wall Type
	a sa ang ang ang ang ang ang ang ang ang an				 Outer Line - Provide Acoustical Batt.
EMPORARY OVE		CONCRETE , GYPSUM BOARD, PLASTER		I	
					Door Number
		TILE		8883	
JD					
				88a	Curtain Wall / Storefront Numb
	LINE SYMBOLS				
				$\langle \mathbf{1t} \rangle$	Window Number
		— — CENTER LINE			
CODE BORATORIES		— — GRID LINE		^	
HERWISE E NOTED		GRID LINE			Keynote Designation
ENOTED					
		– PROPERTY LINE		88	Revision Delta
N TILE	~				
		CUT LINE	N		Vertical Elevation Datum
ING			Eleva	ation	
				Ν	North Arrow
					 Plan North True North
ОМВО				\bigvee –	
				5' 16'	Graphic Scale
RIC				16	
		~			
	GENERAL N	OTES			
VORKING POINT					
	requirements ou	e sprinkler system and alarms to be installed per utlined in code analysis at G-003. Both systems to be the (a) systems in the adjacent building			
		the (e) systems in the adjacent building			
		to f.o. stud, U.O.N. dum #1, Option 3 in the Roofing Replacement Report			
	prepared by Ro	offech Conultants Inc dated March 19, 2012 for cations as needed.			

VICINITY MAP



		BID ALTERNATE SUMMARY	Z	INDE Sheet	EX OF DRAWINGS		
		1. INSTALL NEW EVIDENCE CAGE AND ALL REQUIRED MECHANICAL, PLUMBING, ELECTRICAL & STRUCTURAL ITEMS AT EXISTING VEHICLE STORAGE, RE: DRAWINGS		No.	Sheet Name	CD	
(STORAGE. RE: DRAWINGS 2. INSTALL HEATING AND INSULATION AT EXISTING VEHICLE STORAGE WALLS AND ROOFS, RE: DRAWINGS 2. INSTALL ARIZONA POLYMER EL CORINC (ARE), VEHICLE MAINTENANCE			COVER SHEET	x	
,	ß	3. INSTALL ARIZONA POLYMER FLOORING (APF) VEHICLE MAINTENANCE SYSTEM AT NEW GARAGE INTERIOR; COLOR TO BE SELECTED BY ARCHITECT		G-002 G-003	DRAWING INDEX, GENERAL NOTES, SYMBOLS, LEGENDS, ABBREVIATIONS, VICINITY MAP CODE PLAN / CODE INFORMATION	X X	
		 INSTALL BUS DUCT; ELIMINATE DIRECT WIRE AND INSTALLATION OF 400A PANEL; RE: ELEC PROVIDE 21" 'SOLATUBE' SKYLIGHTS; MODEL #750 DS-O OPEN CLG 		CIVIL			
		W/ LIGHT EXTERIOR INTERCEPTING TRANSFER DEVICE, EXTENSION TUBE, & INTERIOR LENS; PROVIDE STEEL FRAMED OPENINGS AREQ'D; SEE PLAN FOR QTY.		C-100 C-101	COVER SHEET DEMOLITION PLAN	X X	
		 PAINT ALL OVERHEAD STRUCTURE AND INTERIOR EXPOSED CONCRETE WALLS & COLUMNS AT NEW GARAGE; COLOR TO BE SELECTED BY ARCHITECT 	Ž	C-102 C-103 C-104	HORIZONTAL CONTROL PLAN GRADING & UTILITY PLAN EROSION CONTROL PLAN	X X X	
	٦	7. INSTALL INTERIOR LOOPS FOR GARAGE DOORS; SEE 1/A-101 FOR MORE INFO		C-105 C-106	EROSION CONTROL DETAILS OVERALL DRAINAGE PLAN	X X X	
					CTURAL SITE		
				AS-101 ARCHITEC		X	
				A-101 A-201	FLOOR PLAN & PLAN DETAILS REFLECTED CEILING PLAN	X X	
				A-202 A-301	ROOF PLAN & ROOF DETAILS BUILDING ELEVATIONS	X X	
				A-401 A-402	BUILDING SECTIONS WALL SECTIONS	X X	
				STRUCTU S-001	GENERAL NOTES	x	
				S-101 S-201 S-202	FOUNDATION PLAN & DETAILS ROOF FRAMING PLAN & DETAILS WALL FRAMING DETAILS & BRACE FRAME ELEVATIONS &	X X X	
				5-202	DETAILS		
				MECHANIO M-001	MECHANICAL NOTES AND LEGEND	x	
				M-101 M-102 M-201	COMMAND VEHICLE STORAGE MECHANICAL PLAN COMMAND VEHICLE STORAGE MECHANICAL ROOF CONTROLS AND DETAILS	X X X	
					MECHANICAL SCHEDULES	X	
				PLUMBING P-100	G COMMAND VEHICLE STORAGE UNDERGROUND PLUMBING PLAN	x	
				P-101	COMMAND VEHICLE STORAGE PLUMBING PLAN	x	
				ELECTRIC E-100	GENERAL NOTES AND LEGEND	x	
				E-200 E-300 E-400	ELECTRICAL SITE PLAN POWER & LIGHTING PLAN ELECTRICAL PLAN GARAGE MODIFICATIONS	X X X	
				E-500	SCHEDULES	x	
				SECURITY TS-201		x	
ber							



3501 Park Avenue

Denver, CO 80216

Date Issued Delta Description 04/06/12 1 ADDENDUM #1 3 ADDENDUM #2 07/03/12 -_____ _____ -----_____ _____ HUM PHRIES ARCHITECTS All reports, plans, specifications, computer files, field data, notes and other documents and instruments prepared by the Architect as instruments of service shall remain the property of the Architect. The Architect shall retain all common law, statutory and other reserved rights, including copyright thereto. DRAWING INDEX,

GENERAL NOTES,

SYMBOLS, LEGENDS,

ABBREVIATIONS,

VICINITY MAP

BID DOCUMENTS

27 APRIL 2012

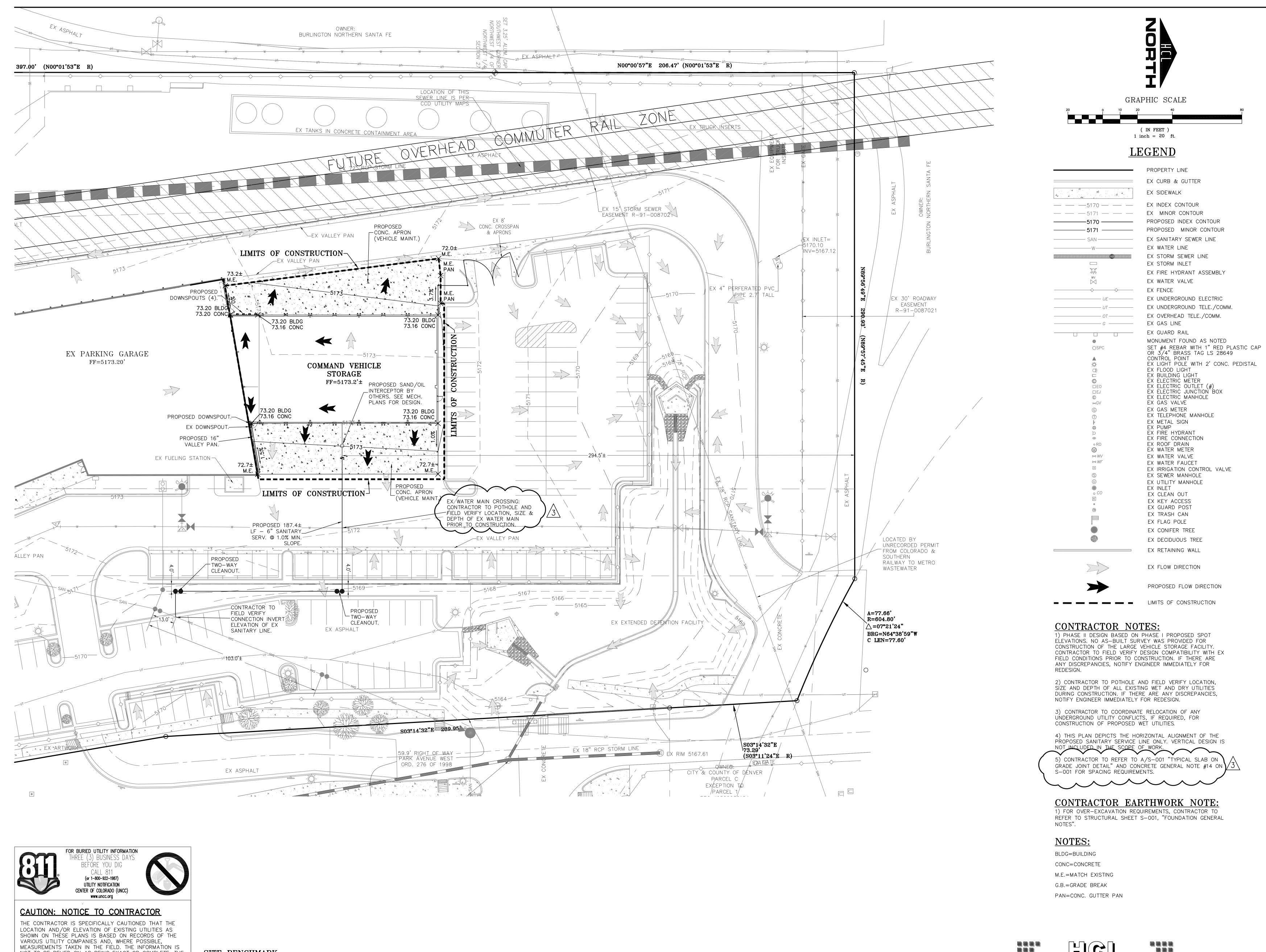
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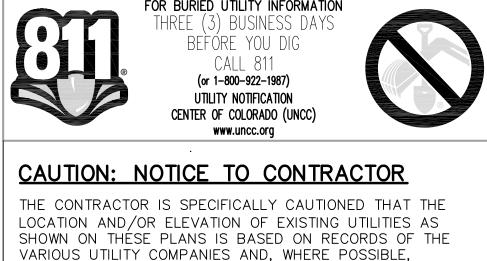
SHEET No.

G-002

28034 AH

RW MW





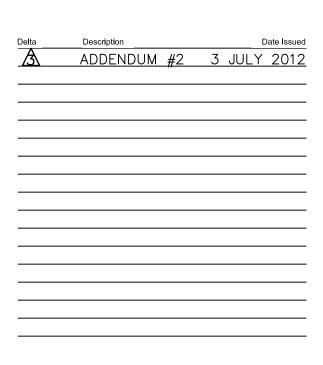
MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE LOCAL UTILITY LOCATION CENTER AT LEAST 48 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATIONS OF THE UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS.

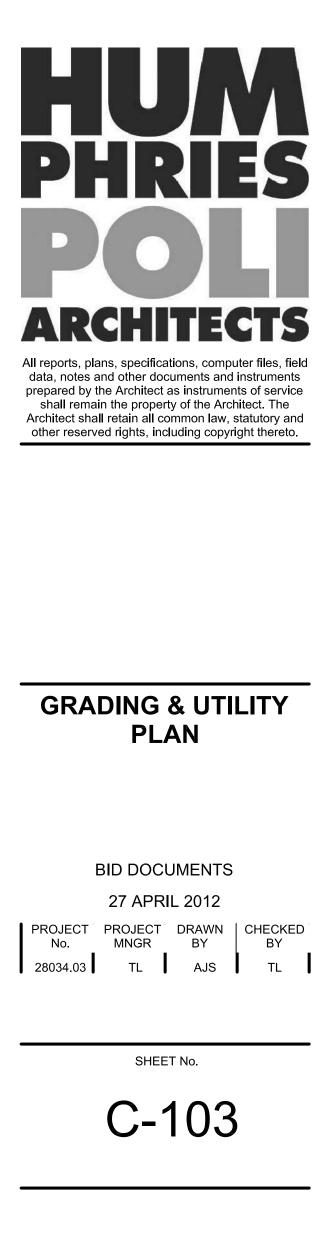
SITE BENCHMARK

CITY & COUNTY OF DENVER BM-499A, LOCATED AT PECOS ST. AND 32ND AVE., CCD BRASS CAP, S.E. CORNER TOP OF CURB @ E END OF INLET WITH AN ELEVATION OF 5212.45 NAVD 1988.



Operations Command Vehicle Storage & Modifications 3501 Park Avenue Denver, CO 80216



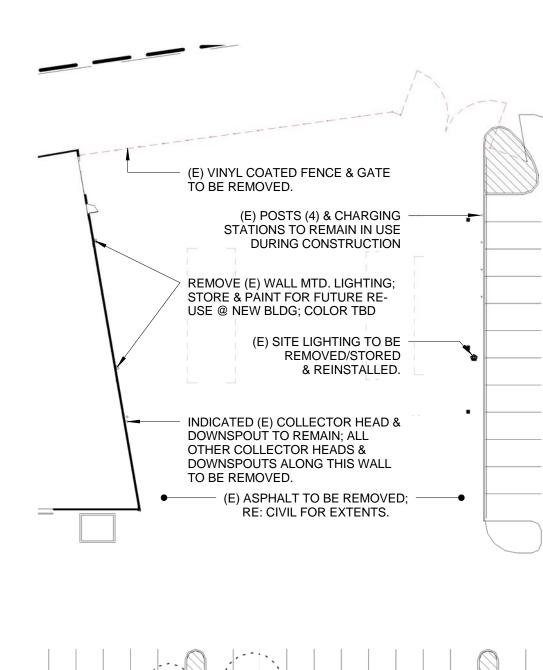


9570 KINGSTON COURT, SUITE 310

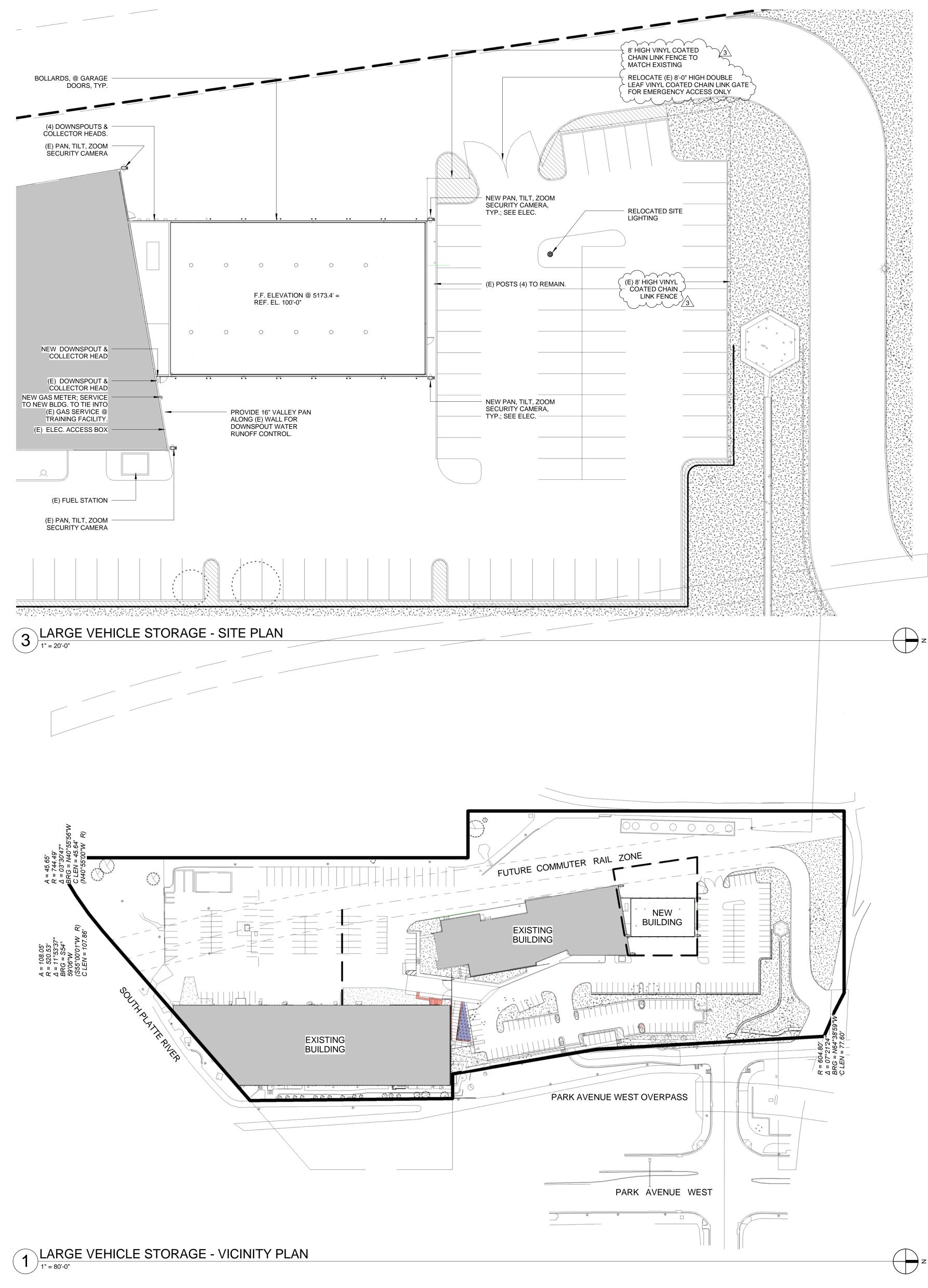
Engineering & Surveying,

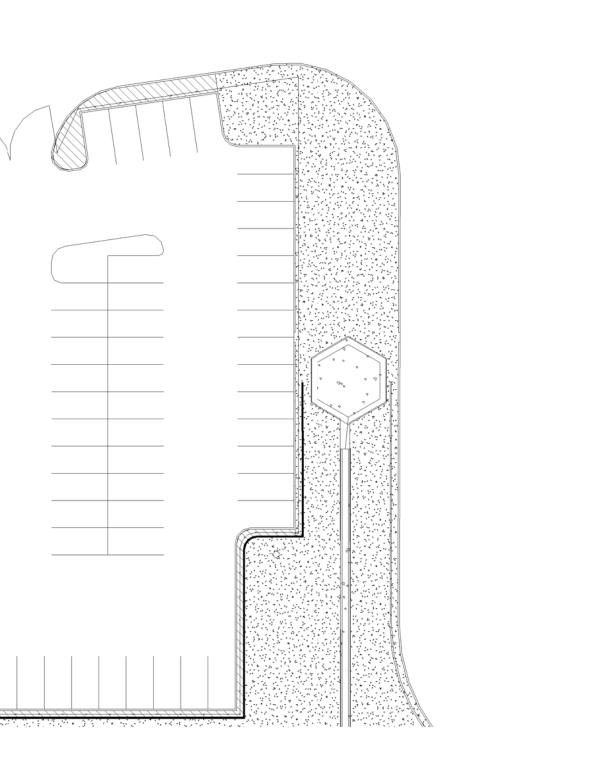
ENGLEWOOD, CO. 80112 • HCLENGINEERING.COM • FAX: (303) 773-3297

PHONE: (303) 773–1605

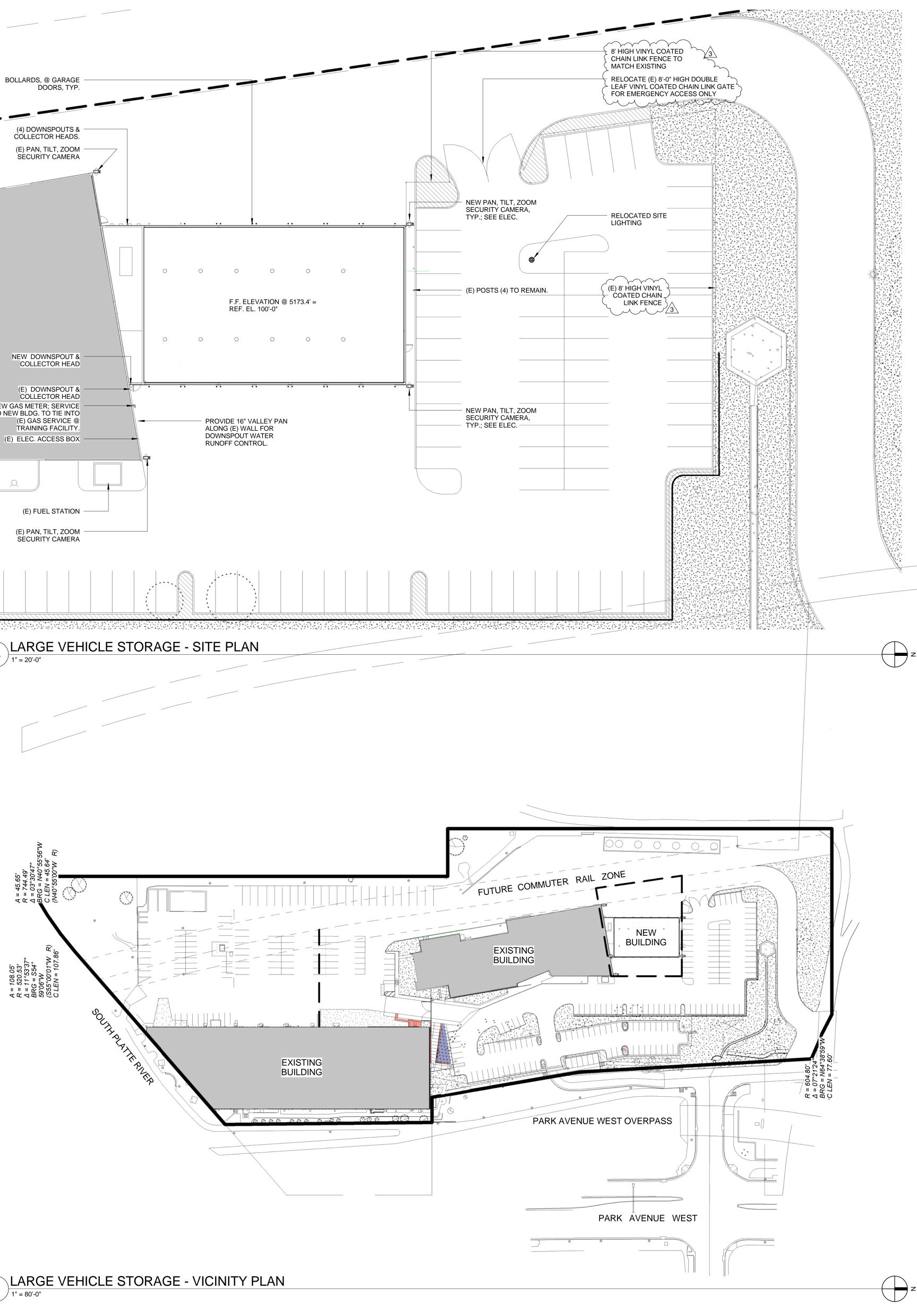


2 LARGE VEHICLE STORAGE - DEMO SITE PLAN





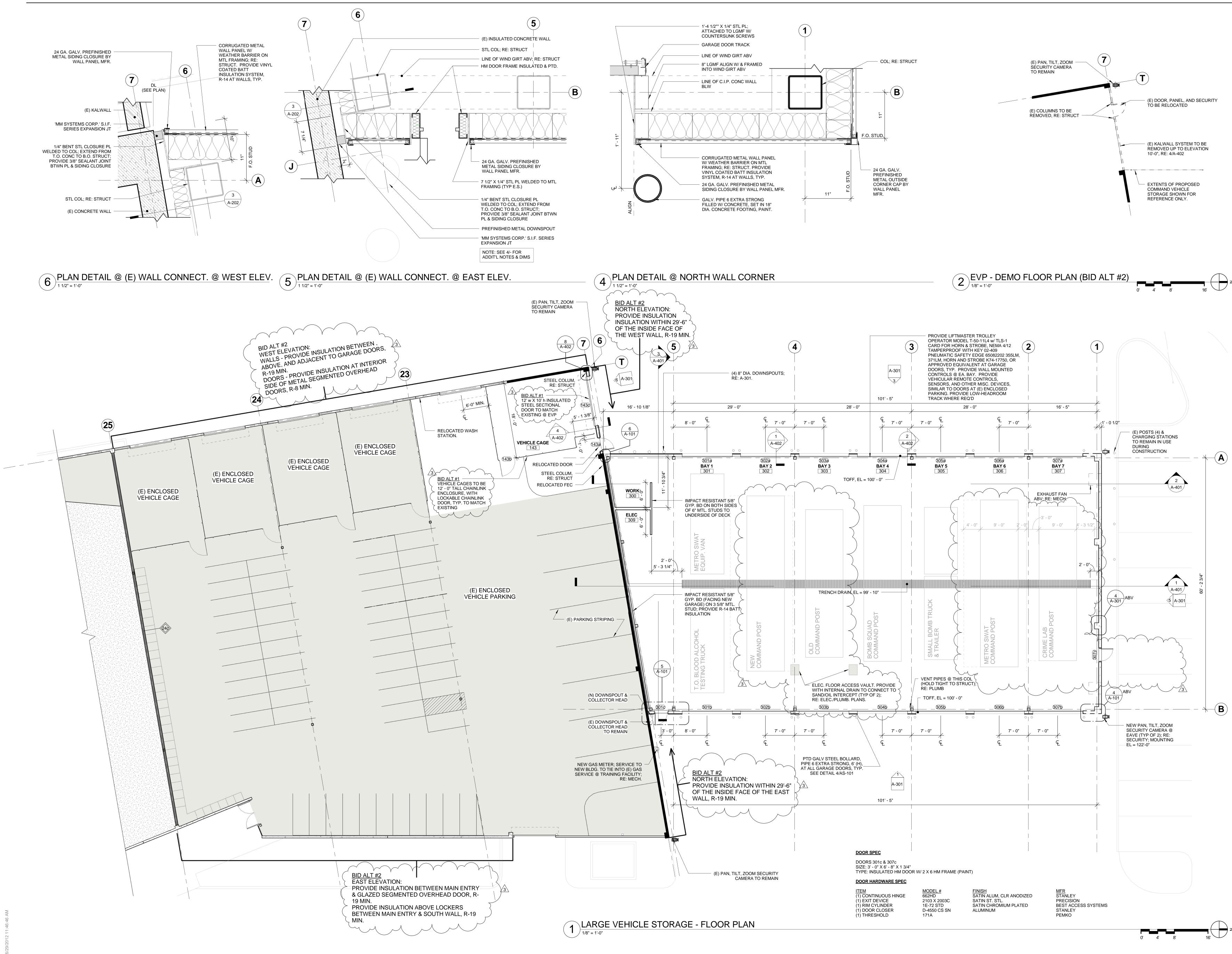
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3501 Park Avenue Denver, CO 80216

Descriptio

Date Issued

ADDENDUM #1 04/06/12 3 ADDENDUM #2 07/03/12 PHRIES ARCH All reports, plans, specifications, computer files, field data, notes and other documents and instruments prepared by the Architect as instruments of service shall remain the property of the Architect. The Architect shall retain all common law, statutory and other reserved rights, including copyright thereto. **FLOOR PLAN & PLAN** DETAILS

BID DOCUMENTS

27 APRIL 2012

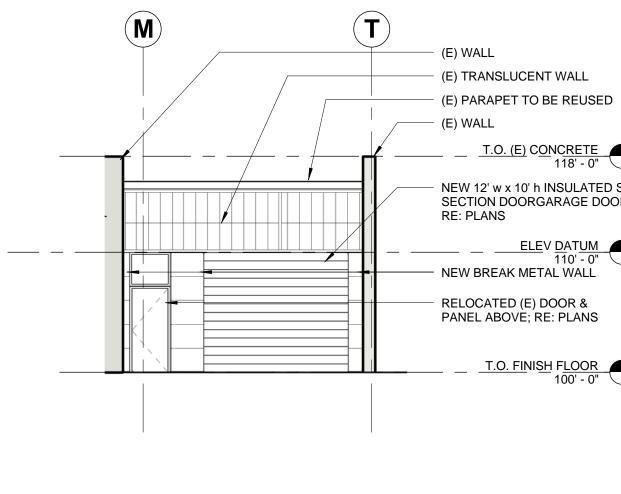
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BY

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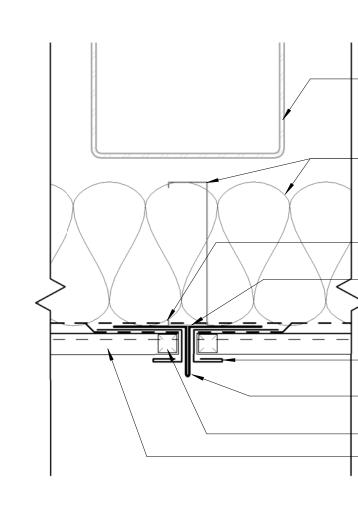
A-101

RW MW

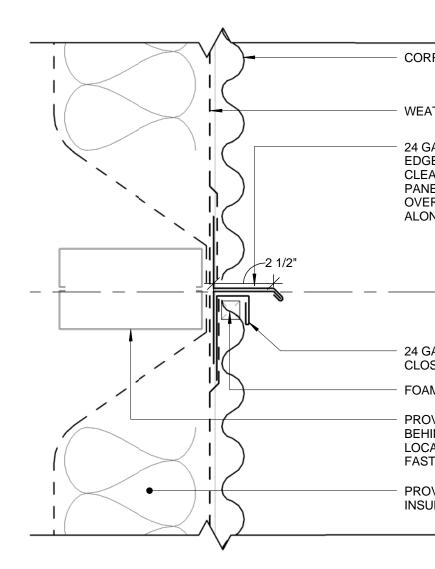
28034 AH





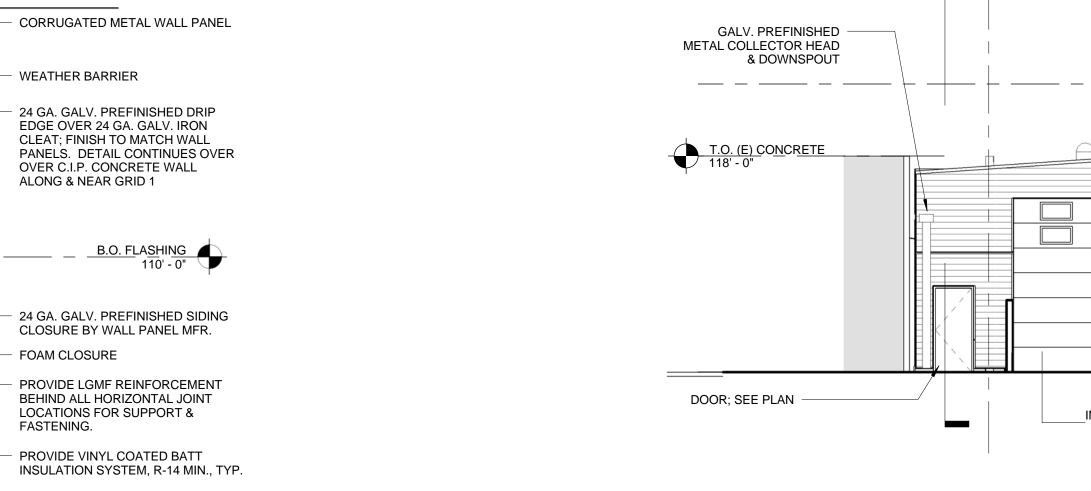


4 METAL PANEL VERT. JOINT



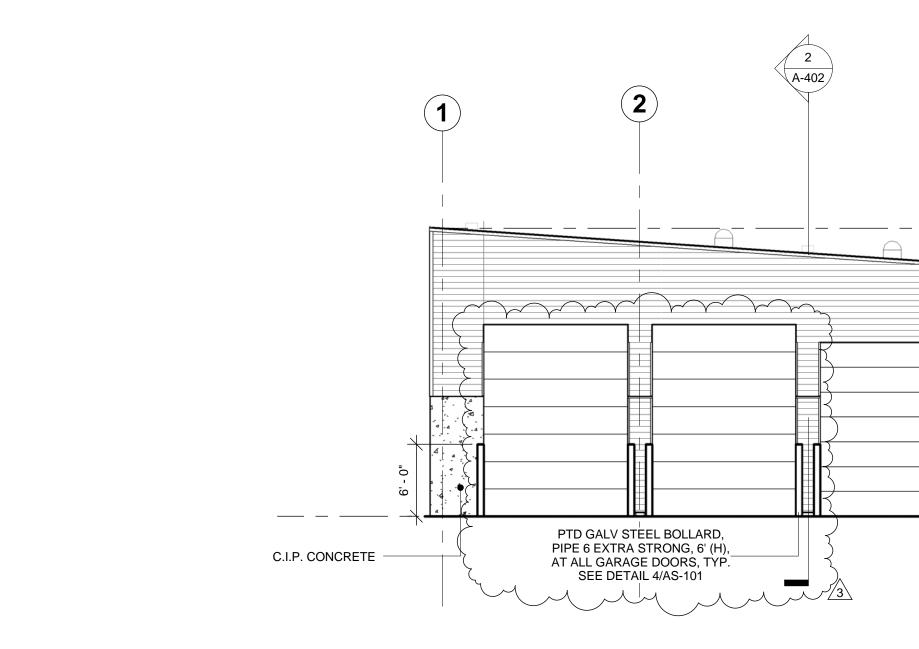
2 METAL PANEL HORIZ. JOINT

1 LARGE VEHICLE STORAGE - EAST ELEVATION



(3) LARGE VEHICLE STORAGE - WEST ELEVATION

\A-401



$6 \frac{\text{LVS - NORTH ELEVATION - TRAINING FACILITY (ADD ALT #2)}}{\frac{1}{9} \frac{1}{4} \frac{3}{8} \frac{3}{16}}$

5 LARGE VEHICLE STORAGE - NORTH ELEVATION

(E) WALL <u>T.O. (E)</u> C<u>ONCRETE</u> 118' - 0" NEW 12' w x 10' h INSULATED STEEL
 SECTION DOORGARAGE DOOR; RE: PLANS ELEV DATUM 110' - 0" NEW BREAK METAL WALL RELOCATED (E) DOOR &
 PANEL ABOVE; RE: PLANS

- STL COL; RE: STRUCT

- LGMF (RE: STRUCT) & INSULATION

- CONTINUOUS METAL CLEAT

24 GA. PREFINISHED SIDING

FINISH TO MATCH PANELS.

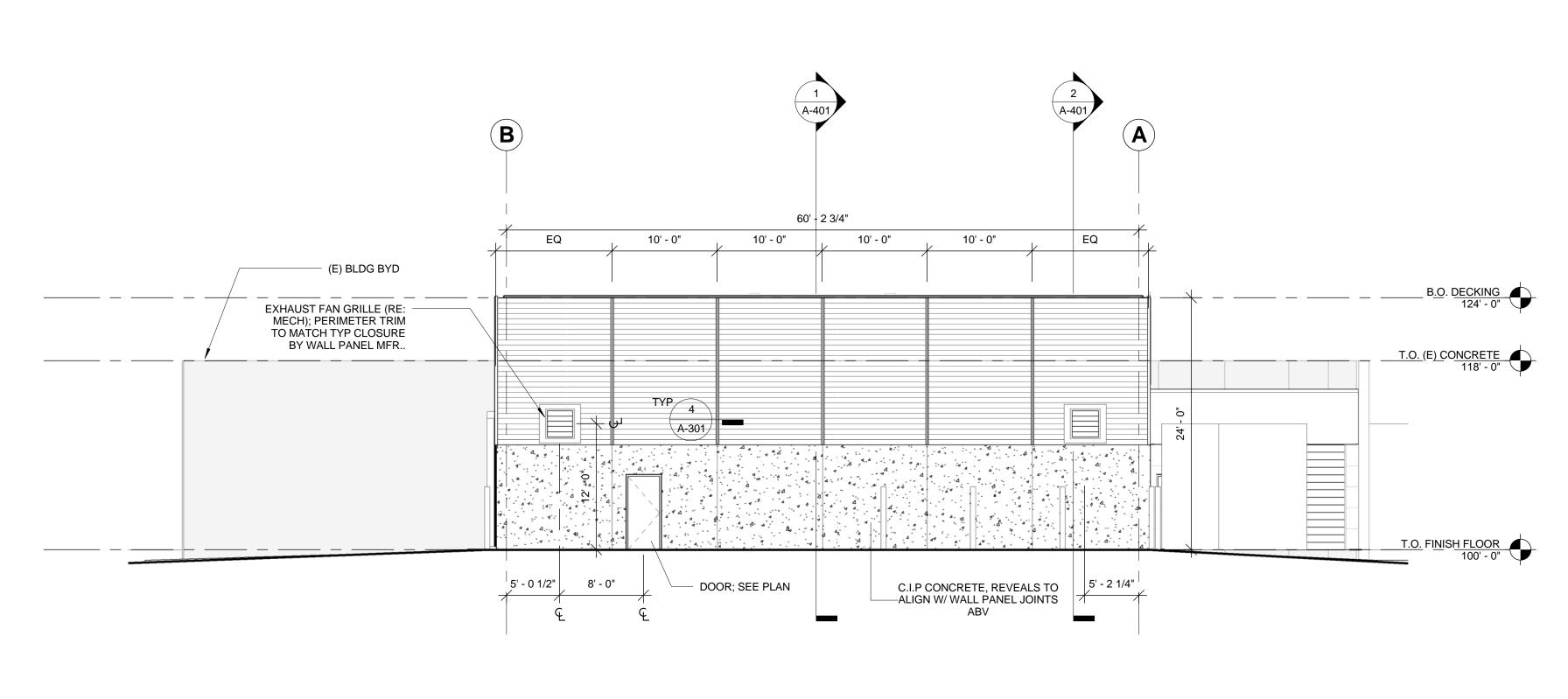
- CORRUGATED METAL PANEL

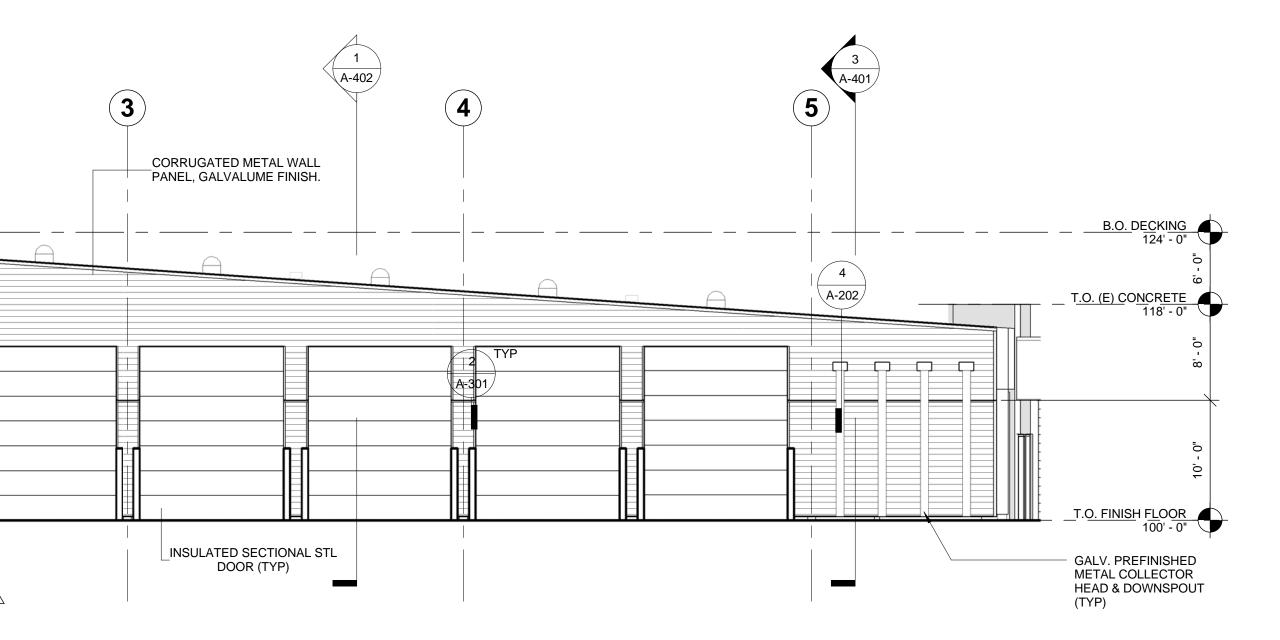
- 24 GA. PREFINISHED JOINT FLASHING;

- BLDG. WRAP

CLOSURE.

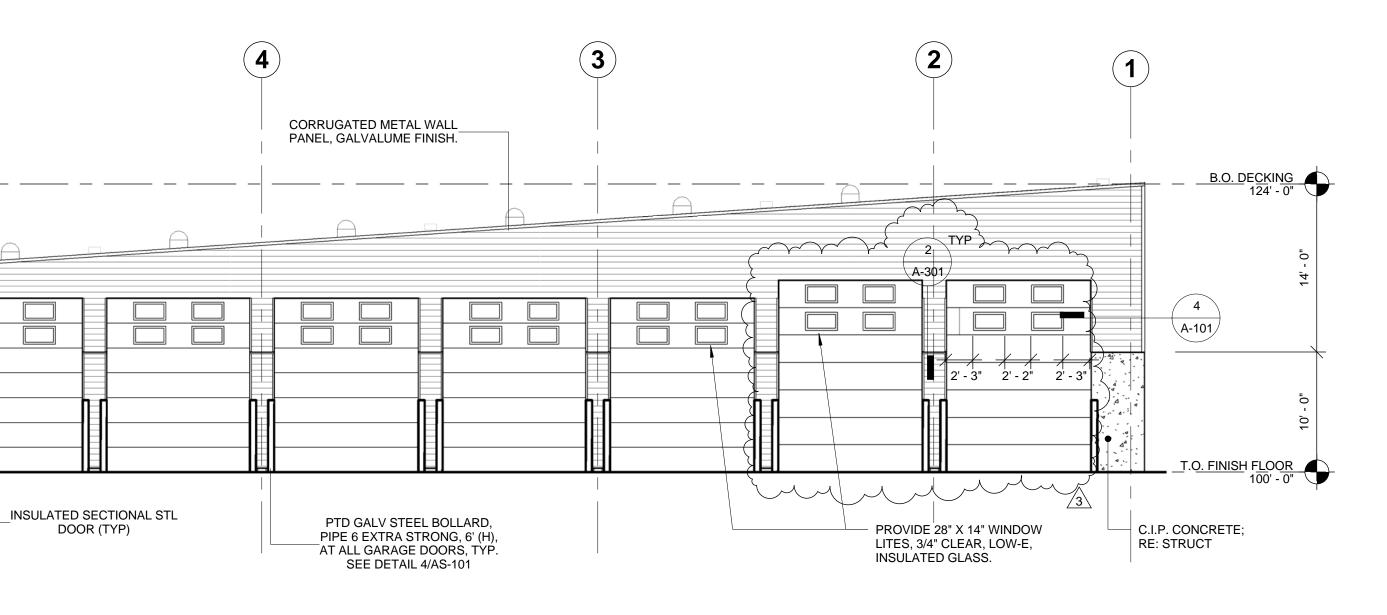
- FOAM CLOSURE





┍┈┓┲┈┝╍ 0' 4' 8'

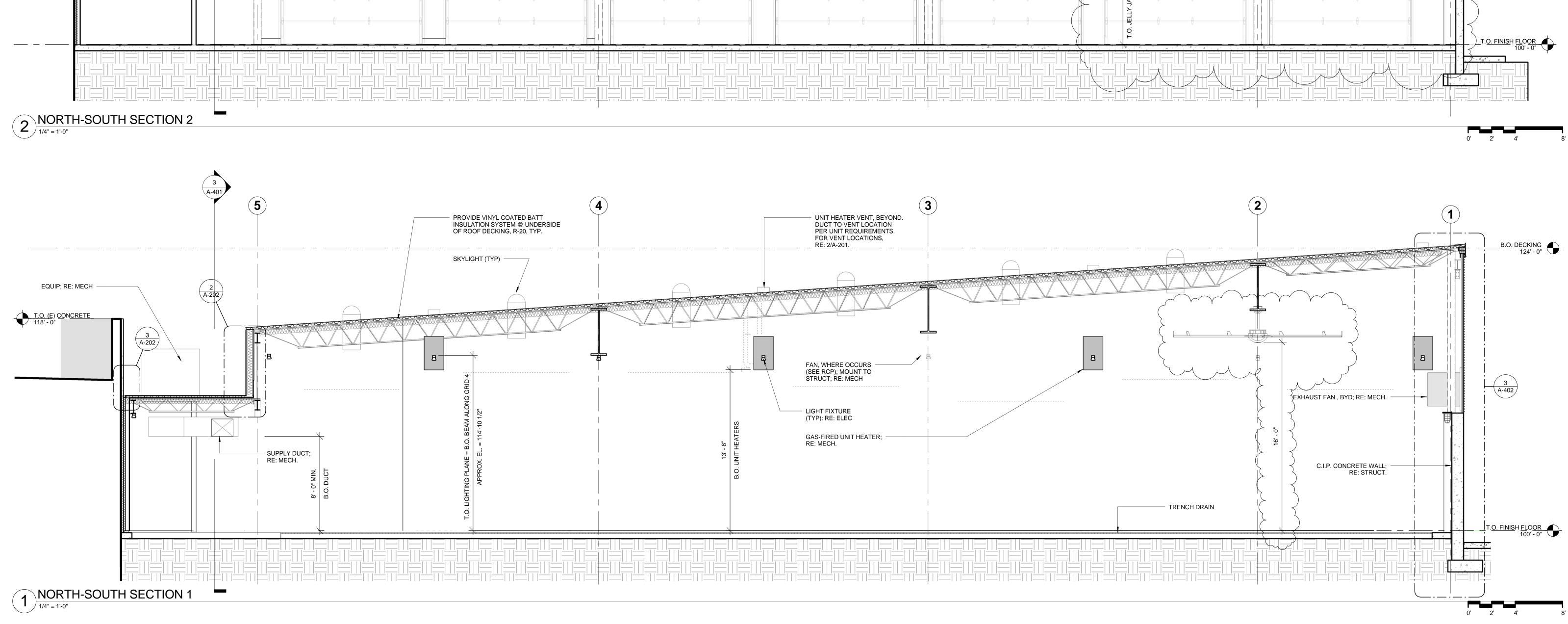
0' 4' 8'

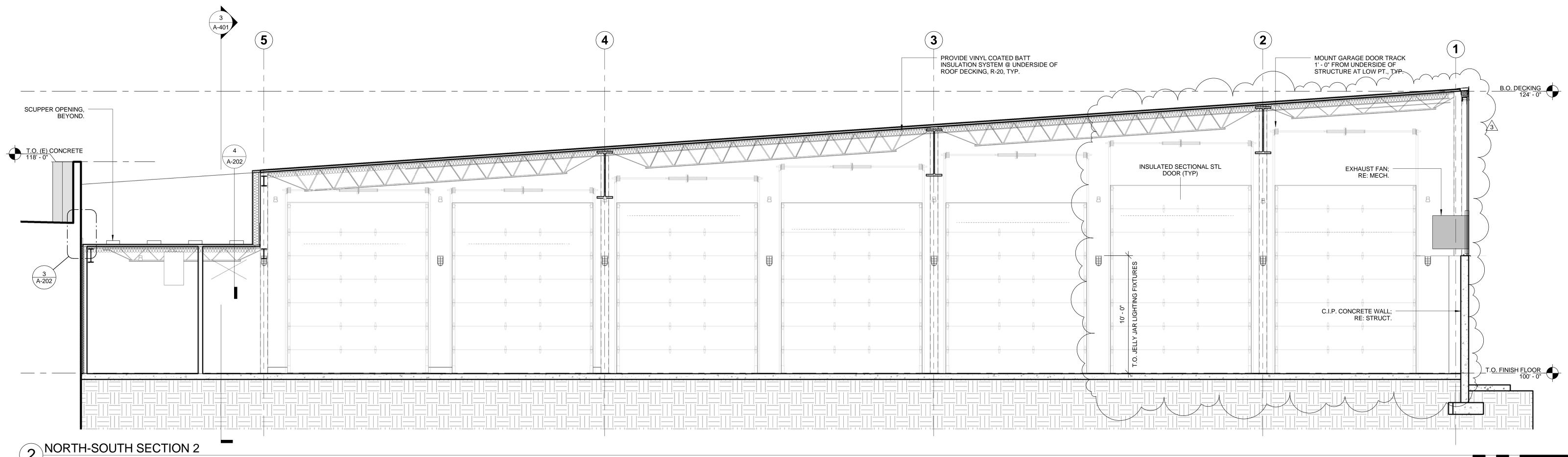




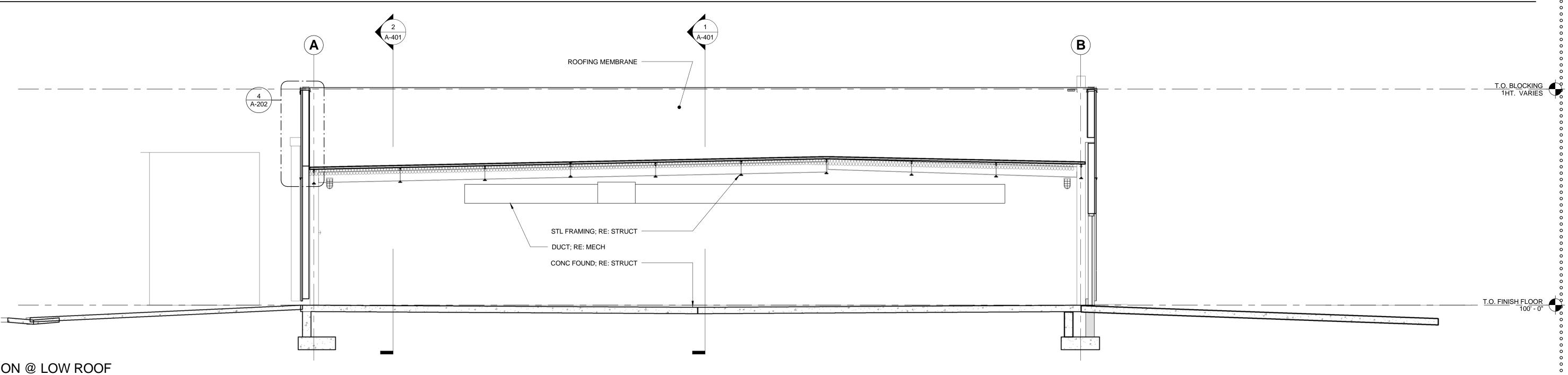
Date Issued 04/06/12 07/03/12 Descriptio 1 ADDENDUM #1 3 ADDENDUM #2 PHRIES





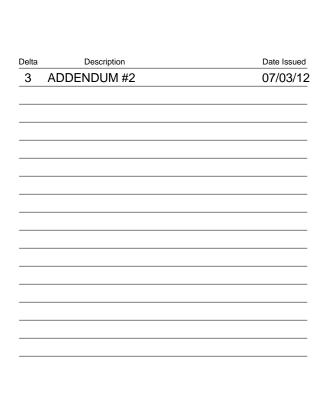




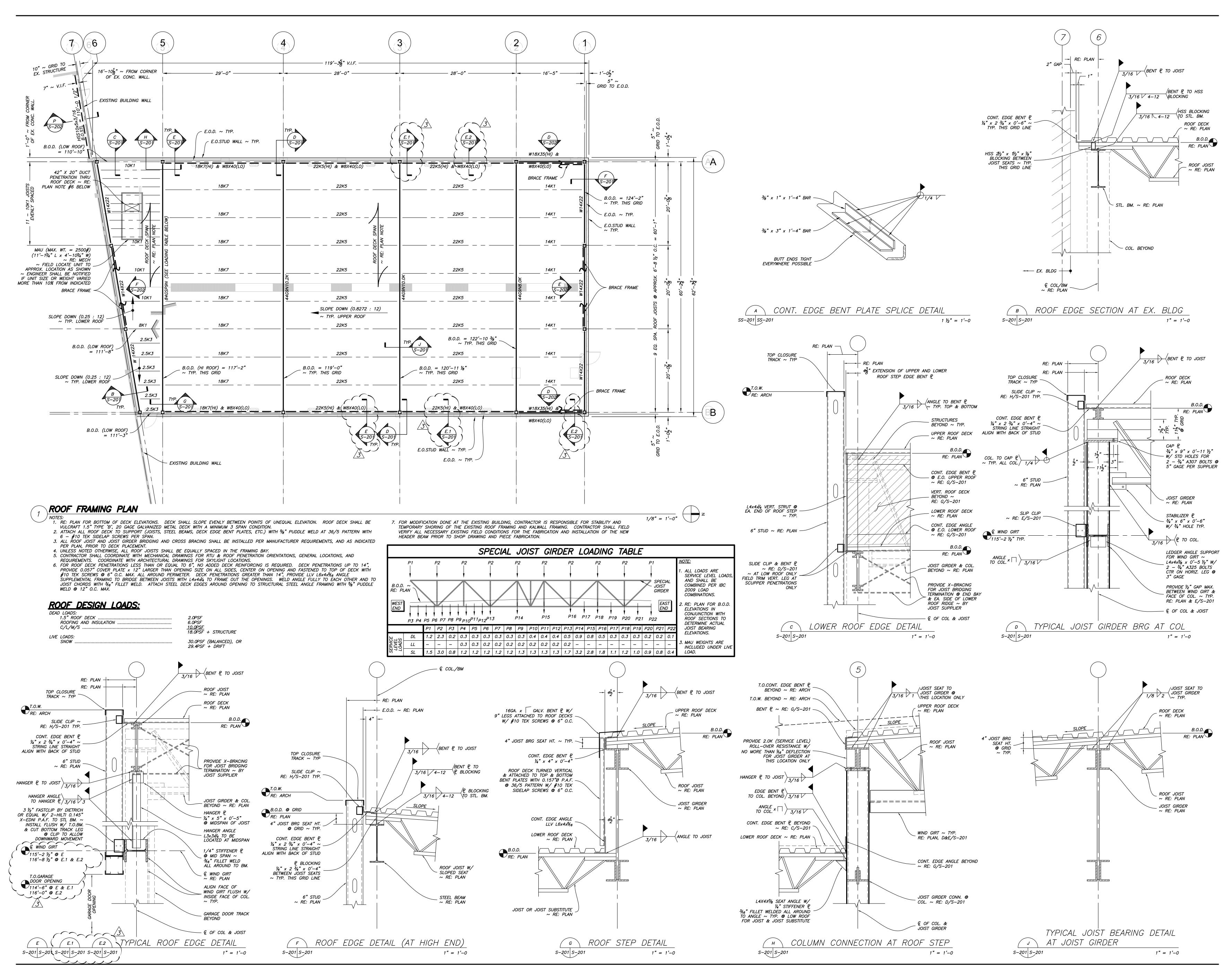


0' 2' 4'











3501 Park Avenue

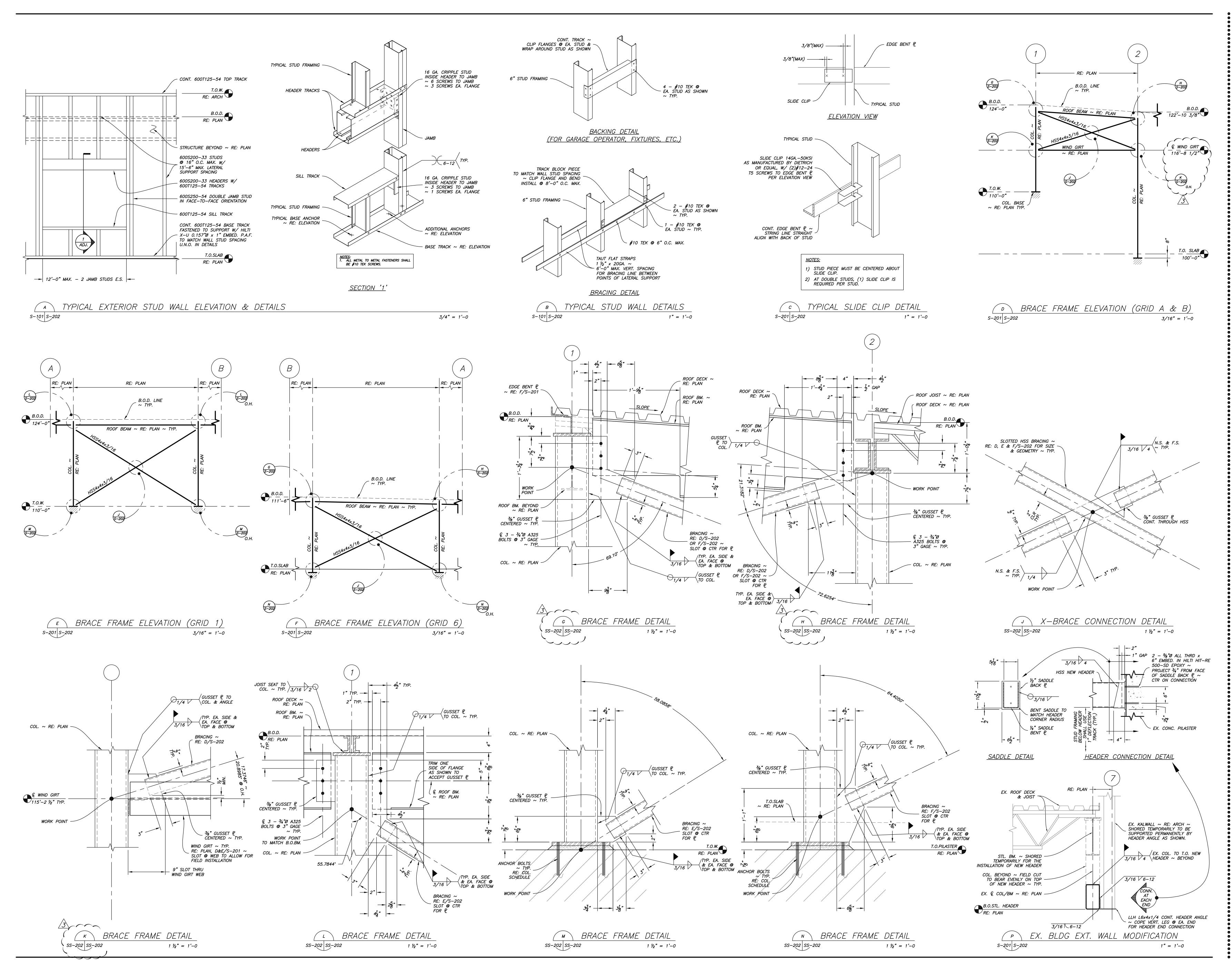
Denver, CO 80216

Date Issued 6 April 2012 ADDENDUM #1 3 ADDENDUM #2 3 July 2012



SHEET No.



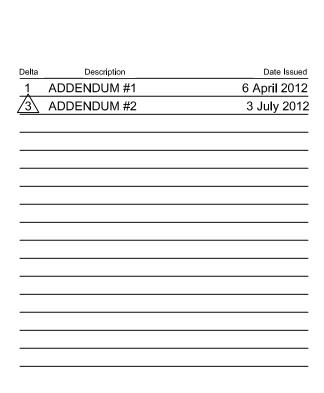




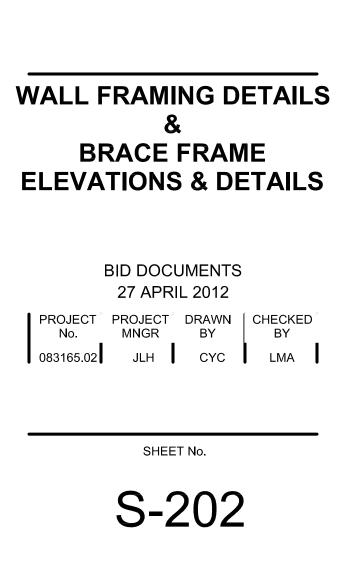
Modifications

3501 Park Avenue

Denver, CO 80216







GENERAL MECHANICAL CONTRACT REQUIREMENTS:

GENERAL:

- 1. UNLESS OTHERWISE NOTED, THE WORK DESCRIBED ON THE PLANS AND SPECIFICATIONS SHALL INCLUDE THE FURNISHING AND INSTALLATION OF ALL LABOR AND MATERIALS NECESSARY FOR COMPLETE AND OPERATIONAL HVAC, FIRE PROTECTION AND PLUMBING SYSTEMS. CONTRACTOR SHALL FURNISH THESE EVEN IF ITEMS REQUIRED TO ACHIEVE THIS (I.E. OFFSETS, ISOLATION AND BALANCING DEVICES, MAINTENANCE CLEARANCES, ETC.) ARE NOT SPECIFICALLY SHOWN.
- 2. DATA GIVEN ON THE DRAWINGS IS AS EXACT AS COULD BE SECURED. ABSOLUTE ACCURACY IS NOT GUARANTEED AND THE CONTRACTOR SHALL OBTAIN AND VERIFY EXACT LOCATIONS, MEASUREMENTS, LEVELS, SPACE REQUIREMENTS, POTENTIAL CONFLICTS WITH OTHER TRADES, ETC. AT THE SITE AND SHALL SATISFACTORILY ADAPT HIS WORK TO THE ACTUAL CONDITIONS OF THE JOB.
- 3. THE DRAWINGS ARE DIAGRAMMATICAL IN NATURE AND SHALL NOT BE SCALED. THEY SHOW CERTAIN PHYSICAL RELATIONSHIPS WHICH MUST BE ESTABLISHED WITHIN THE DIVISION 15 WORK AND ITS INTERFACE WITH OTHER WORK. ESTABLISHING THIS RELATIONSHIP IN THE FIELD IS THE EXCLUSIVE **RESPONSIBILITY OF THE CONTRACTOR. THIS DIVISION SHALL COORDINATE** ITS WORK WITH ALL DIVISIONS OF THE WORK AND ADJUST ITS WORK AS REQUIRED BY THE ACTUAL CONDITIONS OF THE PROJECT.
- A. THE CONTRACTOR SHALL VISIT THE SITE BEFORE SUBMITTING A BID TO BECOME THOROUGHLY FAMILIAR WITH THE ACTUAL CONDITIONS OF THE PROJECT. NO EXTRAS WILL BE ALLOWED DUE TO LACK OF KNOWLEDGE OF EXISTING CONDITIONS.
- B. CERTAIN SYSTEMS REQUIRE ENGINEERING OF INSTALLATION DETAILS BY CONTRACTOR. UNLESS FULLY DETAILED IN THE CONTRACT DOCUMENTS, SUCH ENGINEERING IS THE EXCLUSIVE RESPONSIBILITY OF THE CONTRACTOR.
- C. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE WHERE CLEARANCES ARE LIMITED, AND WHERE INSTALLATION DRAWINGS OR SCHEMATICS, "CONSTRUCTION DRAWINGS", OR COORDINATION DRAWINGS MAY BE REQUIRED IN ACCORDANCE WITH, OR IN EXCESS OF, THOSE REQUIRED BY THE SPECIFICATIONS. THE CONTRACTOR SHALL PREPARE ALL SUCH COORDINATION DRAWINGS AS PART OF THE BASE CONTRACT. SUCH DRAWINGS MAY BE SUBMITTED TO THE ARCHITECT/ENGINEER FOR RECORD AND COMMENT (AT THE CONTRACTOR'S OPTION).
- 4. THESE NOTES ONLY SUPPLEMENT, AND DO NOT REPLACE, THE SPECIFICATIONS. 5. DEFINITIONS AND TERMINOLOGY
- A. THE DEFINITIONS OF DIVISION 1 AND THE GENERAL CONDITIONS OF THIS SPECIFICATION ALSO APPLY TO THE DIVISION 15 CONTRACT DOCUMENTS.
- B. "CONTRACT DOCUMENTS" CONSTITUTE THE DRAWINGS, SPECIFICATIONS, GENERAL CONDITIONS, PROJECT MANUALS, ETC., PREPARED BY ENGINEER (OR OTHER DESIGN PROFESSIONAL IN ASSOCIATION WITH ENGINEER) FOR CONTRACTOR'S BID OR CONTRACTOR'S NEGOTIATIONS WITH THE OWNER. THE DIVISION 15 DRAWINGS AND SPECIFICATIONS PREPARED BY THE ENGINEER ARE NOT CONSTRUCTION DOCUMENTS.
- C. "CONSTRUCTION DOCUMENTS", "CONSTRUCTION DRAWINGS", AND SIMILAR TERMS FOR DIVISION 15 WORK REFER TO INSTALLATION DIAGRAMS, SHOP DRAWINGS AND COORDINATION DRAWINGS PREPARED BY THE CONTRACTOR USING THE DESIGN INTENT INDICATED ON THE ENGINEER'S CONTRACT DOCUMENTS. THESE SPECIFICATIONS DETAIL THE CONTRACTOR'S RESPONSIBILITY FOR "ENGINEERING BY
- CONTRACTOR" AND FOR PREPARATION OF CONSTRUCTION DOCUMENTS. D. "(N)" INDICATES "NEW" EQUIPMENT TO BE PROVIDED UNDER THIS
- CONTRACT. E. "(E)" INDICATES "EXISTING" EQUIPMENT ON SITE WHICH MAY OR MAY NOT NEED TO BE RELOCATED AS A PART OF THIS WORK.
- F. "(R)" INDICATES EXISTING EQUIPMENT TO BE RELOCATED AS PART OF THIS WORK.
- G. "FURNISH" MEANS TO "SUPPLY" AND USUALLY REFERS TO AN ITEM OF EQUIPMENT.
- H. "INSTALL" MEANS TO "SET IN PLACE, CONNECT AND PLACE IN FULL **OPERATIONAL ORDER".**
- I. "PROVIDE" MEANS TO "FURNISH AND INSTALL".
- J. "EQUIVALENT" MEANS "MEETS THE SPECIFICATIONS OF THE **REFERENCE PRODUCT OR ITEM IN ALL SIGNIFICANT ASPECTS."** SIGNIFICANT ASPECTS SHALL BE AS DETERMINED BY THE ARCHITECT/ENGINEER.
- K. "WORK BY OTHER(S) DIVISIONS"; "RE: XX DIVISION", AND SIMILAR EXPRESSIONS MEANS WORK TO BE PERFORMED UNDER THE CONTRACT DOCUMENTS, BUT NOT NECESSARILY UNDER THE DIVISION OR SECTION OF THE WORK ON WHICH THE NOTE APPEARS. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO COORDINATE THE WORK OF THE CONTRACT BETWEEN HIS/HER SUPPLIERS, SUBCONTRACTORS AND EMPLOYEES. IF CLARIFICATION IS REQUIRED, CONSULT ARCHITECT/ENGINEER BEFORE SUBMITTING BID.
- L. BY INFERENCE, ANY REFERENCE TO A "CONTRACTOR" OR "SUB-CONTRACTOR" MEANS THE ENTITY WHICH HAS CONTRACTED WITH THE OWNER FOR THE WORK OF THE CONTRACT DOCUMENTS.
- M. "ENGINEER" MEANS THE DESIGN PROFESSIONAL FIRM WHICH HAS PREPARED THESE CONTRACT DOCUMENTS. ALL QUESTIONS, SUBMITTALS, ETC. OF THIS DIVISION SHALL BE ROUTED THROUGH THE ARCHITECT TO THE ENGINEER (THROUGH PROPER CONTRACTUAL CHANNELS).

ELECTRICAL COORDINATION:

- VERIFY THE ELECTRICAL SERVICE PROVIDED BY THE ELECTRICAL CONTRACTOR BEFORE ORDERING ANY MECHANICAL EQUIPMENT REQUIRING ELECTRICAL CONNECTIONS.
- 2. PROVIDE HIGH EFFICIENCY MOTORS WITH 1.15 SERVICE FACTOR ON ALL EQUIPMENT, MOTORS SHALL BE CAPABLE OF OPERATING CONTINUOUSLY AT 105°F UNDER JOBSITE CONDITIONS AND ALTITUDE.
- 3. UNLESS NOTED OTHERWISE, ALL MECHANICAL EQUIPMENT SHALL BE PROVIDED WITH HOA SWITCH AND STARTER COMPATIBLE WITH EQUIPMENT AND BMS SYSTEM. STARTERS SHALL BE PROVIDED BY DIVISION 15 UNLESS IN A MOTOR CONTROL CENTER. ALL DISCONNECTS SHALL BE FURNISHED BY DIVISION 16.
- 4. THE ELECTRICAL POWER FOR CERTAIN EQUIPMENT PROVIDED UNDER DIVISION 15 HAS NOT BEEN SPECIFICALLY INDICATED ON THE ELECTRICAL DRAWINGS AND MUST BE PROVIDED BY AND FIELD COORDINATED BY THE DIVISION 15 TRADE REQUIRING SUCH POWER.

SUFFICIENT POWER FOR THIS PURPOSE SHALL BE FURNISHED AS "SPARE". DEDICATED CIRCUIT CAPACITY IN DIVISION 16'S PANELBOARDS. ALL WIRING, CONDUIT AND ELECTRICAL DEVICES DOWNSTREAM OF THE PANELBOARDS IS THE RESPONSIBILITY OF THE DIVISION 15 TRADE REQUIRING THE POWER UNLESS OTHERWISE SHOWN ON THE ELECTRICAL DRAWINGS.

- SUCH EQUIPMENT IS HEREBY DEFINED AS:
- A. ELECTRICAL HEAT TRACE. REQUIRED HEAT TRACE LOCATIONS, CAPACITIES AND SPECIFICATION ARE SHOWN OR INDICATED ON THE DRAWINGS. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.
- B. FIRE PROTECTION AIR COMPRESSORS, DRY-PIPE CONTROL PANELS AND VALVES. REQUIRED CONNECTIONS ARE INCLUDED IN THE DIVISION 15300 WORK, AND WILL BE SHOWN BY THAT CONTRACTOR'S ENGINEERED SYSTEM DESIGN DRAWINGS.
- (1) PRE-ACTION SYSTEM INITIATION SIGNALS (SUCH AS SMOKE DETECTORS, OR GENERAL ALARM CONDITIONS IN A PRE-ACTION SHALL BE PROVIDED UNDER DIVISION 16 FIRE-ALARM WORK. ZONE)
- (1) DIVISION 15300 SHALL PROVIDE PRE-ACTION CONTROL PANEL AND INTERCONNECTION BETWEEN NEAREST SUITABLE FIRE ALARM PANEL AND LOCATION OF PRE-ACTION VALVE(S).
- (2) DIVISION 16 SHALL PROVIDE INTERCONNECTION BETWEEN FIRE COMMAND CENTER ALARM PANEL (PROVIDED UNDER DIVISION 16) AND REMOTE COMMUNICATION FIRE ALARM PANEL (PROVIDED UNDER DIVISION 16).

- TEMPERATURE CONTROL PANELS, CONTROL AIR COMPRESSORS AND VOLTAGE POWER FOR 24V CONTROL TRANSFORMERS. REQUIRED **CONNECTION ARE INCLUDED IN DIVISION 15950 AND WILL BE SHOWN** BY THAT CONTRACTOR'S CONTROL SUBMITTAL DRAWINGS.
- D. IT IS NOT PERMISSIBLE TO UTILIZE "SPARE" POWER FROM ADJACENT POWER CIRCUITS TO SERVE ANY OF THE ABOVE LOADS. ALL POWER MUST COME FROM DEDICATED CIRCUITS.

SMOKE DETECTORS:

- FOR AIR HANDLING UNITS AND AIR SYSTEMS WITH A CAPACITY EXCEEDING 2000 CFM, PROVIDE UL LISTED SMOKE DETECTORS IN RETURN AIR SYSTEMS IN ACCORDANCE WITH THE INTERNATIONAL MECHANICAL CO ELSEWHERE AS SHOWN ON THE DRAWINGS.
- SMOKE DETECTORS WILL BE FURNISHED AND SET IN PLACE UNDER THIS DIVISION. DETECTORS WILL BE WIRED UNDER DIVISION 16. SMOKE DETECT MUST BE OF THE SAME MANUFACTURER, AND COMPATIBLE WITH THE FIRE ALARM SYSTEM PROVIDED UNDER DIVISION 16 (IF APPLICABLE).
- CONNECT RELAY(S) TO FAN CONTROL CIRCUIT TO STOP FAN WHEN SMOKE DETECTED. **INSTALLATION:**
- 1. SUSPEND EACH TRADE'S WORK SEPARATELY FROM THE STRUCTURE. SHALL BE HELD TIGHT TO STRUCTURE EXCEPT WHERE OTHERWISE SHOWN
- INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY INDICATED
- OTHERWISE OR WHERE LOCAL CODES OR REGULATIONS TAKE PRECEDEN PROVIDE MANUFACTURER'S RECOMMENDED SERVICE CLEARANCE ARC EQUIPMENT REQUIRING SAME.
- 4. PROVIDE FOR SAFE CONDUCT OF THE WORK, CAREFUL REMOVAL AND OF MATERIALS AND PROTECTION OF PROPERTY WHICH IS TO REMAIN UNDIS
- 5. PROVIDE ACCESS DOORS FOR ALL EQUIPMENT, VALVES, CLEANOUTS, AND CONTROLS WHICH REQUIRE ACCESS FOR ADJUSTMENT OR SERVICING WHICH ARE LOCATED IN OTHERWISE INACCESSIBLE LOCATIONS.
- A. FOR EQUIPMENT LOCATED IN "ACCESSIBLE LOCATIONS" SUCH AS LAY-**CEILINGS: LOCATE EQUIPMENT TO PROVIDE ADEQUATE SERVICE CLEAF** FOR NORMAL MAINTENANCE WITHOUT REMOVING ARCHITECTURAL, ELE OR STRUCTURAL ELEMENTS SUCH AS THE CEILING SUPPORT SYSTEM, ELECTRICAL FIXTURES, ETC. "NORMAL MAINTENANCE" INCLUDES, BUT NOT LIMITED TO:FILTER CHANGING; GREASING OF BEARINGS; USING P/7 PORTS FOR PRESSURE OR TEMPERATURE MEASUREMENTS; SERVICING CONTROL VALVES AND SERVICING CONTROL PANELS.
- 6. ISOLATE ALL PRESSURIZED PIPE (WATER, ETC.) AT EACH RISER, BRANC OF EQUIPMENT, AND AREA SERVED.
- 7. PROVIDE PRIMERS FOR ALL FLOOR DRAINS AND FLOOR SINKS SHOWN DRAWINGS. PRIMERS MAY BE CONNECTED TO FLUSH FIXTURES OR BE STA ALONE. SEE SPECIFICATIONS.
- 8. NO DOMESTIC WATER, CHILLED WATER, OR HEATING WATER LINES SHA LOCATED EXPOSED IN FINISHED SPACES OR BELOW THE BUILDING SLAB UN SHOWN OTHERWISE ON THE DRAWINGS.
- NO GAS LINES SHALL BE LOCATED BELOW BUILDING SLAB.
- 10. ALL CURBS, ROOF JACKS, ROOF THIMBLES, SANITARY VENTS, ROOF DF ETC. SHALL BE COMPATIBLE WITH ROOFING SYSTEM TO BE PROVIDED. REFERENCE ARCHITECTURAL DIVISION FOR REQUIRED FLASHING DETAILS.
- 11. MECHANICAL CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL CON EQUIPMENT PAD DIMENSIONS, BASED ON THE FINAL EQUIPMENT SELECTION TO THE STRUCTURAL AND GENERAL CONTRACTOR FOR INCLUSION IN THOS CONTRACTOR'S WORK AS DESCRIBED BY THE GENERAL CONTRACTOR.
- 12. WARRANTY: AT A MINIMUM, THE ENTIRE MECHANICAL SYSTEM SHALL WARRANTED AGAINST DEFECTS IN MATERIALS AND WORKMANSHIP FOR A OF ONE (1) YEAR AFTER ACCEPTANCE OF THE SYSTEM BY THE OWNER. REF TO INDIVIDUAL SPECIFICATION SECTIONS FOR SPECIFIC WARRANTY REQUIR
- DUCTWORK INSTALLATION:
- 1. SEAL ALL SEAMS (LONGITUDINAL AND TRANSVERSE) AIR TIGHT WITH SE SPECIFICATIONS.
- 2. DUCT DIMENSIONS ARE INSIDE CLEAR.
- 3. DIFFUSER NECK SIZE IS SAME AS FLEXIBLE DUCT SIZE.
- 4. UNLESS OTHERWISE NOTED, ALL CHANGES IN DIRECTION SHALL BE MAD RADIUS ELBOWS WITH RADIUS TO CENTERLINE EQUAL TO 1.5 DUCT WIDTH.
- 5. WHERE REQUIRED FOR SPACE CONSTRAINTS, PROVIDE MITERED ELBOW TURNING VANES AS FOLLOWS:
- A. FOR DUCT WIDTHS OF 36" OR LESS, PROVIDE MANUFACTURED SINGLE WIDTH TURNING VANES. WITH NO TRAILING EDGES AND SPACING IN ACCORDANCE WITH SMACNA DUCT CONSTRUCTION STANDARDS FOR "STANDARD SPACING".
- B. USE DOUBLE THICKNESS (AIRFOIL) BLADES WITHOUT TRAILING EDGES FOR DUCT WIDTHS GREATER THAN 36".
- 6. ALL FLEXIBLE DUCTS SHALL NOT BE LESS THAN 4', OR MORE THAN 10' IN LENGTH. INSTALL FLEXIBLE DUCTWORK SUCH THAT:
- A. MINIMUM OVERALL LENGTH OF 3D, STRAIGHT INTO NECK OF DIFFUSER.
- B. MAXIMUM OF 135° OF TOTAL TURNING IN ENTIRE LENGTH OF FLEXIBLE
- C. MINIMUM TURNING RADIUM OF R = 1.5D.
- WHERE: D = FLEXIBLE DUCT DIAMETER
- * R = RADIUS OF TURN AS MEASURED TO CENTERLINE OF DUCT.
- 7. BRANCH LINES:
- A. MAKE ALL TAPS TO ROUND DUCTWORK WITH CONICAL TEES.
- B. MAKE ALL TAPS TO RECTANGLE DUCTWORK WITH 45° ENTRY OR CONIC SPIN IN TO ROUND.
- C. INCLUDE DAMPERS AT ALL BRANCH LINES.
- 8. DUCT SIZES NOT CALLED OUT SHALL BE DETERMINED BASED ON 0.08" S.F OR LESS PER 100 FT. OF LENGTH.
- 9. ASSUME ROUND OR OVAL DUCTS IN EXPOSED AREAS.
- 10. INCLUDE DAMPERS AT ALL BRANCH LINES, WHERE SHOWN ON THE DRAW WHERE OTHERWISE REQUIRED FOR BALANCING.

PIPE INSTALLATION:

- . ALL PIPING SHALL BE ADEQUATELY SUPPORTED FROM THE BUILDING STRUCTURE TO PREVENT SAGGING, POCKETING, SWAYING OR DISPLACEME MEANS OF HANGERS AND SUPPORTS. PIPING IS NOT TO BE SUPPORTED BY EQUIPMENT.
- 2. PROVIDE DIELECTRIC UNIONS BETWEEN DISSIMILAR MATERIALS.
- 3. PROVIDE MANUAL AIR VENTS AND CAPPED HOSE-END DRAINS WITH ISOL VALVES AT PIPING HIGH AND LOW POINTS.
- 4. WELD PIPE IN ACCORDANCE WITH APPLICABLE CODES AND STANDARDS WELDERS SHALL BE CERTIFIED FOR TYPE OF WORK BEING PERFORMED.
- 5. FLUSH OUT PIPING AND REMOVE CONTROL DEVICES BEFORE PERFORM PRESSURE TEST. DO NOT USE PIPING SYSTEM VALVES TO ISOLATE SECTIO WHERE TEST PRESSURE EXCEEDS VALVE PRESSURE RATING. PRESSURIZE PIPING AT 100 PSIG. IF LEAKAGE IS OBSERVED OR IF TEMPERATURE COMPENSATED PRESSURE DROP EXCEEDS 1% OF TEST PRESSURE. REPA AND RETEST. DO NOT USE AIR PRESSURE TO TEST PLASTIC PIPE.
- 6. PROVIDE SUPPORT UNDER ELBOWS ON PUMP SUCTION AND DISCHARGE
- 7. ALL STRAINERS SHALL BE FURNISHED WITH A "ROUGHING" SCREEN AND (2) SCREENS FOR NORMAL OPERATION. INSTALL STRAINER WITH ROUGHIN SCREEN AND OPERATE SYSTEM FOR 24 HOURS MINIMUM (RUN DOMESTIC W SYSTEMS AT MAX FLOW FOR A MINIMUM OF ONE HALF (1/2) HOUR. REMOVE
- ROUGHING SCREEN AND INSTALL NORMAL SCREEN, AFTER TWO WEEKS OF OPERATION INSTALL NEW NORMAL SCREEN. 8. PIPING SIZES SHALL BE BASED ON 2' OR LESS HEAD LOSS PER 100 FEET VELOCITIES SHALL NOT EXCEED 10 FEET PER SECOND.
- 9. INSTALL ALL PIPING TO ALLOW FOR EXPANSION AND CONTRACTION WIT PIPING SYSTEM. ENSURE ALL REQUIRED PIPE EXPANSION WILL OCCUR IN PROPER DIRECTION AND SEGMENT OF PIPE. PROPERLY ANCHOR (RE: SPEC ALL PIPING REQUIRING EXPANSION/CONTRACTION ISOLATION, COORDINAT EXPANSION/CONTRACTION TO PREVENT DAMAGE TO ANY AND ALL BUILDIN COMPONENTS.
- 10. PROVIDE ISOLATION VALVES AT EVERY HYDRONIC BRANCH LINE.

LINE	LOUVERS: 1. ALL LOUVERS LOCATED ON EXTERIOR WALLS SHALL BE PROVIDED BY ARCHITECTURAL DIVISION. ALL OTHER LOUVERS SHALL BE PROVIDED BY DIVISION 15. REQUIRED LOUVER FREE AREAS ARE INDICATED ON DIVISION 15 DRAWINGS. IT IS THE RESPONSIBILITY OF THIS CONTRACTOR TO CONFIRM THAT THE REQUIRED FREE AREA HAS BEEN PROVIDED, PRIOR TO CONNECTION TO THAT LOUVER. DIVISION 15 SHALL PROVIDE ALL LOUVER PLENUMS.
	CUTTING, PATCHING AND DEMOLITION:
G DDE AND	1. KEEP DEMOLITION & CUTTING TO MINIMUM REQUIRED FOR PROPER EXECUTION OF WORK.
	2. BE RESPONSIBLE FOR ALL CUTTING AND PATCHING NECESSARY FOR THE COMPLETION OF THE WORK.
TORS	3. NO CUTTING (NOT SHOWN ON THE CONTRACT DOCUMENTS) SHALL BE DONE WITHOUT THE APPROVAL OF THE ARCHITECT AS TO LOCATIONS, METHOD AND EXTENT OF THE CUTTING.
E IS	4. REPAIR ALL ACCIDENTAL OR INTENTIONAL DAMAGE TO MATCH EXISTING CONSTRUCTION WITH NO NOTICEABLE DIFFERENCE IN CONTINUITY, APPEARANCE OR FUNCTION.
DUCTWORK N.	5. ALL "CAPPED" SANITARY AND VENT LINES SHALL BE RECONNECTED OR RE- ROUTED AS NECESSARY TO PREVENT "DEAD-ENDS" IN THE PIPING. ALL PIPING SHALL DRAIN TO ACTIVE SANITARY WASTE LINES AND ALL BRANCHES WITH TRAPS SHALL BE ADEQUATELY VENTED.
CE. OUND ALL	GENERAL PLUMBING CONTRACT REQUIREMENTS: 1. THE GENERAL MECHANICAL REQUIREMENTS PERTAIN TO THE WORK OF THIS
DISPOSITION STURBED.	DIVISION. 2. PREPARE SHOP DRAWINGS OF ALL NEW WORK (INCLUDING SLEEVE LOCATIONS) TO VERIFY LOCATIONS AND COORDINATION OF WORK BETWEEN TRADES PRIOR TO INSTALLATION.
ACTUATORS AND	3. ALL DRAIN GRATES, CLEANOUT COVERS, AND OTHER FINISHED, EXPOSED COMPONENTS SHALL BE PROTECTED FROM DAMAGE. DAMAGED COMPONENTS SHALL BE REPLACED BY CONTRACTOR AT NO ADDITIONAL COST TO THE
IN RANCE ECTRICAL	CONTRACT. 4. COORDINATE ROUTING OF ALL PLUMBING PIPING BELOW SLAB WITH STRUCTURAL GRADE BEAMS, TIE BEAMS, ETC. ALLOW FOR REROUTING OF
IS T ;	 PIPING AS REQUIRED. 5. ALL REQUIRED OPENINGS IN CONCRETE BEAMS AND STRUCTURAL WALLS ARE TO BE ACCOMPLISHED USING SLEEVES PROPERLY SIZED FOR THE PIPE THEY SERVE. CORE DRILLING IN BEAMS IS NOT ALLOWED. CORE DRILLING IN
CH, PIECE ON	 PANS IS ALLOWED UPON PRIOR APPROVAL OF ARCHITECT AND STRUCTURAL ENGINEER. 6. HORIZONTAL STORM AND SANITARY PIPING SHALL RUN AT A SLOPE OF 1/4"
ND	 PER FOOT MINIMUM FOR 3" AND SMALLER PIPING. 4" AND LARGER PIPING SHALL RUN AT 1/8" PER FOOT MINIMUM. 7. NO DOMESTIC WATER LINES SHALL BE LOCATED EXPOSED IN FINISHED
ALL BE NLESS	 NO DOMESTIC WATER LINES SHALL BE LOCATED EXPOSED IN FINISHED SPACES OR BELOW THE BUILDING SLAB UNLESS SHOWN OTHERWISE ON THE DRAWINGS. 8. WHERE SHOWN, MINIMIZE THE NUMBER OF JOINTS ON ANY PRESSURIZED
RAINS,	 WHERE SHOWN, MINIMIZE THE NUMBER OF JOINTS ON ANY PRESSURIZED PIPING BELOW CONCRETE SLABS. ALL BELOW GRADE PIPING TO BE PRESSURE TESTED AND WITNESSED BY ARCHITECT BEFORE BACKFILLING. ALL CLEANOUTS FOR HORIZONTAL STORM DRAINAGE SYSTEM SHALL BE PIPE
CRETE	 ALL CLEANOUTS FOR HORIZONTAL STORM DRAINAGE SYSTEM SHALL BE PIPE SIZE OR MAXIMUM 6" FOR LARGER PIPE. IN ADDITION TO THE CLEANOUT LOCATIONS SHOWN ON DRAWINGS, PROVIDE
N, SE	ALL UPPER TERMINALS.
SE PERIOD	 ALL UPPER TERMINALS. B. EACH RUN OF PIPING WHICH IS MORE THAN 100 FEET IN LENGTH OR FRACTION THEREOF.
ER EMENTS.	C. HORIZONTAL LINES 5 FEET OR MORE.
LANT PER	D. HORIZONTAL LINES FOR EACH AGGREGATE CHANGE OF DIRECTION EXCEEDING 135 DEGREES.
	E. AT THE BASE OF ALL WASTE AND VENT RISERS. ALL VERTICAL CLEANOUTS SHALL BE SIZED TO ACCOMMODATE THE LARGEST PIPE ON THAT BRANCH LINE, BUT NEVER LARGER THAN 4".
	11. NO GAS LINES SHALL BE LOCATED BELOW BUILDING SLAB. ALL GAS PIPING IN AIR PLENUMS TO BE WELDED.
EWITH	12. PROVIDE ISOLATION VALVES ON ALL PIPING SERVING HOSE BIBBS.
S WITH	13. ANY ELECTRICAL SPACE NOT CONSTRUCTED WITH A SUB-ROOF WHICH MAY HAVE PLUMBING PIPING AT THE CEILING OF THESE SPACES SHALL HAVE A DRIP PAN INSTALLED BELOW THE PIPING. DRIP PANS SHALL BE 1.5 TIMES THE WIDTH OF THE PIPING SERVED WITH A MINIMUM OF 2" HIGH SIDES. DRIP PANS SHALL BE SUSPENDED FROM THE PIPING SERVED AND SHALL SLOPE AT A MINIMUM 1/8"/FT. DRIP PANS SHALL DISCHARGE WITH MIN. 1-1/2" DR TO FLOOR DRAINS.
	A. DO NOT LOCATE PIPING DIRECTLY ABOVE ANY ELECTRICAL EQUIPMENT IN ELECTRICAL ROOMS.
	14. MAINTAIN DESIGNATED PLUMBING FIXTURE HEADER SIZE FOR FULL BANK OF FIXTURES.
UCT.	15. PROVIDE GAS VENTS EXTENDING CONTINUOUSLY FROM ALL INTERIOR GAS REGULATORS TO THE EXTERIOR OF THE BUILDING. TERMINATE AT AN APPROVED LOCATION. SIZE VENTS SUCH THAT MINIMUM VENT SIZE (FOR VENT WHICH IS 10 FEET OR LESS IN LENGTH) EQUALS RELIEF OUTLET PIPE SIZE. INCREASE VENT PIPE SIZE ONE PIPE SIZE FOR EVERY ADDITIONAL
	TEN FEET OF VENT PIPE LENGTH. A. PROVIDE AN ISOLATION VALVE DOWNSTREAM OF EVERY INTERIOR GAS
	REGULATOR. 16. PROVIDE HEAT TRACE FOR ALL PIPING EXPOSED TO WEATHER INCLUDING BUT NOT LIMITED TO:
AL	A. STORM DRAIN BODIES.
	B. HORIZONTAL STORM LINES ABOVE GROUND AND EXTERIOR TO THE BUILDING.C. SANITARY TRAPS ABOVE GROUND AND EXTERIOR TO THE BUILDING.
. LOSS	D. DOMESTIC WATER LINES ABOVE GROUND AND EXTERIOR TO THE BUILDING.
	E. ELSEWHERE AS INDICATED ON THE DRAWINGS OR SPECIFICATIONS. SEISMIC RESTRAINTS:
VINGS, AND	 LOCATE, SELECT, DESIGN AND INSTALL SEISMIC RESTRAINTS FOR ALL MECHANICAL SYSTEMS. INCLUDE RESTRAINTS FOR DUCTWORK, PIPING AND EQUIPMENT.
ENT BY	2. COMPLY WITH THE REQUIREMENTS OF THE "GUIDELINES FOR SEISMIC RESTRAINTS OF MECHANICAL SYSTEMS AND PLUMBING PIPING SYSTEMS", CURRENT EDITION, PUBLISHED JOINTLY BY THE SHEET METAL INDUSTRY FUND OF LOS ANGELES, CALIFORNIA AND THE PLUMBING AND PIPING
ATION	INDUSTRY COUNCIL INC., LOS ANGELES, CALIFORNIA. 3. REFER TO STRUCTURAL PLANS FOR SEISMIC LOAD DESIGN CRITERIA.
ATION	STRUCTURE: 1. DO NOT PENETRATE STRUCTURAL MEMBERS. ALL EQUIPMENT SUPPORTS SHALI
IG NS	 BE ATTACHED TO THE LOAD BEARING MEMBERS OF STRUCTURAL ELEMENTS. DO NOT OVER-STRESS ANY STRUCTURAL MEMBERS. CONTACT STRUCTURAL ENGINEER FOR ALLOWABLE LOADS FOR SPECIFIC MEMBERS. 2. DO NOT UTILIZE POWER DRIVEN ANCHORS FOR ANY LOCATIONS WHICH REQUIRE THE LOAD TO BE HELD IN TENSION. SEE STRUCTURAL DIVISION FOR ADDITIONAL RESTRICTIONS.
LEAKS	3. SEE ALSO STRUCTURAL DIVISION FOR ACCEPTABLE ANCHORING AND SUPPORT
LINES. TWO G	 MEANS, METHODS, AND LOCATIONS. PROVIDE FLEXIBLE CONNECTORS, EXPANSION LOOPS, EXPANSION JOINTS, ADDITIONAL FITTINGS OR EQUIVALENT TO ACCOMMODATE THE THERMAL EXPANSION OF THE BUILDING THROUGH STRUCTURAL EXPANSION JOINTS.
IG ATER NORMAL	PROVIDE SUCH FITTING AT EVERY PIPE, DUCT, CONDUIT, ETC. CROSSING OF A STRUCTURAL EXPANSION JOINT. <u>CONSTRUCTION VENTILATION:</u>
T OF	1. WHERE EXISTING OR NEW MECHANICAL SYSTEMS ARE USED FOR TEMPORARY VENTILATION OR CLIMATE CONTROL, MECHANICAL EQUIPMENT INSTALLER
HIN THE HE IFICATIONS)	SHALL PROVIDE CONSTRUCTION FILTERS, MAINTAIN EQUIPMENT, AND CLEAN, ADJUST AND PUT IN NEW CONDITION BEFORE BUILDING OCCUPANCY. PARTS AND LABOR WARRANTY SHALL NOT BE CONSIDERED TO START UNTIL ACCEPTANCE OF SYSTEM BY OWNER.
E PIPE IG	

				(NOT ALL SYMBOLS	CHAN LISTED BELOW		AL LEC	END	CAL DRA	WINGS)		
SYMBOL DOUBLE SINGLE	ABBR	DESCRIPTION	SYMBOL	ABBR	DESCRIPTION	SYMBOL	ABBR	DESCRIPTION	SYMBOL	ABBR	DESCRIPTION	SYMBOL ABBR	
HVAC:		RETURN DUCT	PIPING: — (E) —	(E)	EXISTING PIPING		GV	GATE VALVE	SYMBOLS:		UNDERCUT DOOR	ABBREVIATIONS	
		UP			EXISTING PIPING TO BE REMOVED		0S&Y	OUTSIDE STEM AND		UC	(UNDER ARCH. SECTION) DOOR LOUVER	GPH	GALLONS PER HOUR
		SUPPLY DUCT UP	— A —	А	CONTROL AIR		DV	YOKE DRAIN VALVE W/		D/L	(UNDER ARCH. SECTION)	GPN	MINUTE
			—— ВД———	BD	(PNEUMATIC) BOILER BLOW			HOSE END CONŃ.	L/D	L/D	LOUVER DOOR FULL HEIGHT. (UNDER	GV	GRAVITY VENTILATOR, GATE VALVE
		EXHAUST DUCT UP	BF	BF	DOWN BOILER FEED	<u> </u>		BALL VALVE W/ HOSE CONNECTION			ARCH. SECTION) RETURN/ EXHAUST	HC HP	HEATING COIL HORSEPOWER
		SUPPLY DUCT	BO	BO	BLOW OFF		cv	CHECK VALVE WITH INDICATION OF FLOW			AIR FLOW SYMBOL	HU	HUMIDIFIER SECTION
		DOWN	CF	CF	CHEMICAL FEEDER PROCESS COOLING		PRV	DIRECTION PRESSURE	-		SUPPLY AIR FLOW SYMBOL	HZ	HERTZ
		RETURN DUCT	PCS —	PCS	WATER SUPPLY PROCESS COOLING		sv	REDUCING VALVE	ABBREVIA		REMOVE OR	IN. W	C. INCH WATER COLUMN
		DOWN	PCR —	PCR	WATER RETURN	FC	50	SOLENOID VALVE	(R) (E)	(R) (E)	RELOCATE EXISTING (PAREN-	ISOL KW	ISOLATOR KILOWATTS
		EXHAUST DUCT DOWN	HWS	HWS	HEATING WATER SUPPLY		FCV	VALVE W/ TEST PORTS	(Ľ)	(Ľ)	THESIS AROUND	LBS	
			HWR	HWR	HEATING WATER RETURN		CS,BV	CIRCUIT SETTER OR BALANCING VALVE	(N)	(N)	IT IS EXISTING) NEW		R POUNDS PER HOUR
		ROUND DUCT DOWN	—HTWS—	HTWS	HIGH TEMP. HOT WATER SUPPLY			GLOBE VALVE		DN	DOWN	LVG MA	LEAVING MAKE-UP AIR
		ROUND DUCT	HTWR-	HTWR	HIGH TEMP. HOT WATER RETURN		GLV	(STRAIGHT PATTERN)		AFF AFG	ABOVE FIN. FLOOR ABOVE FIN. GRADE	МАХ	. MAXIMUM
		UP	— снѕ —	CHS	CHILLED WATER SUPPLY		GLV	GLOBE VALVE (ANGLE PATTERN)		TOD	TOP OF DUCT (AFF)	MCA	MINIMUM CIRCUIT
		DUCT DROP	— CHR —	CHR	CHILLED WATER RETURN	—1)—	BFV	BUTTERFLY VALVE		BOD TOP	BOT. OF DUCT (AFF) TOP OF PIPE (AFF)	MBH	THOUSAND BTUH
		TRANSITION-RECT.	cws	CWS	CONDENSER	-0-	BV	BALL VALVE		NTS AF	NOT TO SCALE AFTER FILTER	MCA	
		TO RECT. OR ROUND TO ROUND	CWS	CWR	WATER SUPPLY CONDENSER	₩	тсv	AUTOMATIC TEMP. CONTROL		AF	ABOVE FINISHED	мсс	MOTOR CONTROL CENTER
		TRANSITION-RECT. TO ROUND		LPS	WATER RETURN LOW PRESSURE			VALVE, 2-WAY AUTOMATIC		AH	FLOOR AIR HANDLING UNIT	MIN	
			—_LPS—_ →MPS→_	MPS	STEAM SUPPLY MEDIUM PRESSURE		TCV	TEMP. CONTROL VALVE, 3-WAY		AL	ALUMINUM	MOCI	P MAX. OVER CURRENT PROTECTION
		VANED ELBOW	/ MPS / -+HPS+	HPS	STEAM SUPPLY HIGH PRESSURE		PV	PLUG VALVE		AMB. AP	AMBIENT ACCESS PANEL	MTL	METAL
		CAPPED DUCTWORK			STEAM SUPPLY LOW PRESSURE	Į . Į	TPR	PRESSURE RELIEF VALVE		B	BOILER	MUA	
		EXISTING	LPR	LPR	STEAM CONDENSATE RETURN	\bigcirc		VALVE IN RISER		BHP	BRAKE HORSE POWER	NC OA	NOISE CRITERIA OUTSIDE AIR
		DUCTWORK NO CHANGE		MPR	MEDIUM PRESSURE STEAM CONDENSATE	L C	STR	STRAINER W/ BLOW-OFF		BTUH	BRITISH THERMAL	0.0	ON CENTER
		EXISTING		HPR	RETURN MEDIUM PRESSURE STEAM CONDENSATE			& CAPPED HOSE- END CONNECTION		CAV	UNIT PER HOUR CONSTANT AIR	OPN	G OPENING PUMP
¥A <i>\$++++</i> *		DUCTWORK TO BE REMOVED			RETURN PUMPED CONDENSATE			STEAM TRAP		СС	VOLUME COOLING COIL	P.D.	PRESSURE DROP/
		DUCT W/ INTERNAL LINING 1L= 1" THICK	-0-PR-0-	PR	RETURN	SYMBOLS:		SECTION NO.		CFH	CUBIC FEET PER HOUR	PF	DIFFERENTIAL ' PRE-FILTER
		2L= 2" THICK		RS	REFRIGERANT SUCTION	F		SHEET NO.		CFM	CUBIC FEET PER MINUTE	PRES	S PRESSURE
	FD	FIRE DAMPER	RL	RL	REFRIGERANT LIQUID	F		DETAIL		СН	CHILLER	PSIG	POUNDS PER SQUARE
	SD	SMOKE DAMPER. CONTROLLED BY DUCT	RHG	RHG	REFRIGERANT HOT GAS			DESIGNATION		COP	COEFFICIENT OF PERFORMANCE	PWL	SOUND POWER LEVEL
	50	SMOKE DETECTOR	DR	DR	EQUIP. DRAIN	$\left(\begin{array}{c} F\\ 1\end{array}\right)$	- - -	EQUIPMENT		CRU	CONDENSATE	QTY.	QUANTITY RETURN AIR
	SD (C)	SMOKE DAMPER. CONTROLLED BY	D	D V	INDIRECT DRAIN VENT	F	<u>F–1</u>	DESIGNATION		CV	RETURN UNIT CONSTANT VOLUME	REF	REFERENCE
	30 (0)	CORRIDOR OR AREA SMOKE DETECTOR	IW	IW	INDUSTRIAL WATER					dB	DECIBEL	RF	RETURN FAN
	FSD	FIRE SMOKE DAMPER. CONTROLLED BY DUCT	— SCW — FITTINGS:	SCW	SOFT COLD WATER	``````````````````````````````````````		SHEET KEY NOTES		DB	DRY-BULB DIRECT DIGITAL	RH	RELATIVE HUMIDITY RUNNING LOAD AMP
		SMOKE DETECTOR FIRE SMOKE DAMPER.	ч Ч	Р&Т	PRESSURE/ TEMPERATURE		POC	(CONN. NEW TO EXISTING)		DDC	CONTROL	RPM	
	FSD (C)	CONTROLLED BY CORRIDOR OR AREA			PORT TAPS		POD	POINT OF DISCONNECTION		DEFL DIA	DEFLECTION DIAMETER	RQD	
		SMOKE DETECTOR		CR	CONCENTRIC REDUCER	$OR \overset{A SIZE}{OFM} (X)$		AIR DEVICE CALL OUT. TYP. OF (X)		DN	DOWN	SA	SUPPLY AIR
	MD	DAMPER		ER	ECCENTRIC REDUCER	TYPE	BB	DEVICES.		DP	DISCHARGE PLENUM	SCFN	STANDARD AIR CUBIC FEET PER MINUTE
	MVD	MANUAL VOLUME DAMPER W/ LOCKING			EXPANSION	T(E)	(E) T	CALL OUT EXIST. THERMOSTAT		DWG EA	DRAWING EXHAUST AIR	SF	SUPPLY FAN
		QUADRANT		EJ	JOINT	() (L) ()	Т	NEW THERMOSTAT		EDR	EFFECTIVE DIRECT RADIATION	SHT	SHEET S SPECIFICATIONS
	BD	BACKDRAFT DAMPER		U	UNION			SPACE TEMPERATURE		EER	ENERGY EFFICIENT	S.P.	STATIC PRESSURE
r r		CONICAL TAP						SENSOR SPACE HUMIDISTAT		EF	EXHAUST FAN	SQ.	SQUARE
					W/THERMOWELL			SPACE HUMIDITY		EFF ENT	EFFICIENCY	SS ST	STAINLESS STEEL SOUND TRAP
t t		CONICAL SPIN-IN FITTING W/ MANUAL		AV	AIR VENT	l B		SENSOR SPACE PRESSURE		EN I ESP	EXTERNAL STATIC	TG	TRANSFER GRILLE
		VOLUME DAMPER		FC	FLEXIBLE PIPE CONNECTOR			SENSOR CARBON DIOXIDE		•F	PRESSURE DEGREE FAHRENHEIT	TSP	TOTAL STAIC PRESSURE
		SUPPLY DIFFUSER	FS —	FS	FLOW SWITCH			SENSOR CARBON MONOXIDE		FC	FAN COIL UNIT	TYP	TYPICAL
		SUPPLY DIFFUSER- 4-WAY THROW		PS	PRESSURE SWITCH	I I I I I I I I I I I I I I I I I I I		SENSOR DUCT MOUNTED		F.G. FF	FIBERGLASS	UON	NOTED
		SUPPLY DIFFUSER-			PRESSURE			SMOKE DETECTOR ARROW INDICATES		۲۲ FLA	FINAL FILTER FULL LOAD AMP.	UTR VAV	UP THROUGH ROOF VARIABLE AIR VOLUME
		3-WAY THROW	<u> </u>	PG	GAUGE W/GAUGE COCK			DIRECTION OF FLOW		FPI	FINS PER INCH	VEL.	VELOCITY
		SUPPLY DIFFUSER- 2-WAY THROW	<u> </u>		ELBOW UP			RISE IN DIRECTION OF AIRFLOW		FPM	FEET PER MINUTE	VSD	VARIABLE SPEED DRIVE
		SUPPLY DIFFUSER- 1-WAY THROW	C—		ELBOW DOWN			DROP IN DIRECTION OF AIRFLOW		FRIC.	FRICTION	VTR	VENT THROUGH ROOF
		SUPPLY SLOT DIFFUSER			TEE UP		WL	EXTERIOR WALL LOUVER (UNDER		FT FS	FLASH TANK FLOOR SINK	WB WF	WET-BULB WATER FILTRATION
	RA	RETURN AIR GRILLE			TEE DOWN PIPE CAP OR			ARCH. SECTION)		FT. W.C	. FEET WATER COLUMN	W/	WITH
\sim		LOW PRESSURE FLEXIBLE DUCT			PIPE CAP OR PLUG							w/0	WITHOUT
	AP	CEILING ACCESS PANEL											
		HUMIDIFIER											
		FLEXIBLE DUCT											
NOTES		CONNECTION				L							
	UCTWORK	K IS HEAVY LINE WEIG	HT AND/OR SI	HADED.									

GAS FIRED VENTING REQUIREMENTS:

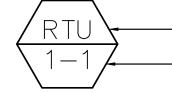
1. ALL FLUES SERVING GAS FIRED EQUIPMENT SHALL BE DOUBLE WALL TYPE "B" BY METALBESTOS CO. OR EQUAL. TERMINATE FLUES A MINIMUM HEIGHT ABOVE ROOF (AS DETERMINED BY CODE) WITH WEATHER CAP. SLOPE HORIZONTAL RUNS TOWARD POINT OF ORIGINATION AT MINIMUM 1/4" PER 1'.

- ELECTRIC HEAT FREEZE PROTECTION:
- 1. PIPE HEAT TRACE CABLE:
- A. HEAT TRACE CABLE SHALL BE INSTALLED BY A LICENSED ELECTRICIAN.
- B. APPLY THE HEAT TRACE CABLE ON THE PIPE AFTER PRESSURE
- TESTING.
- (1) DO NOT SPIRAL WRAP ON PIPE.
- (2) MAKE ONE WRAP AT VALVES.
- (3) SECURE TO PIPE WITH METHODS APPROVED BY MANUFACTURER.
- C. APPLY "ELECTRICALLY TRACED" SIGNS ON OUTSIDE OF INSULATION.
- D. TEST PER MANUFACTURER'S RECOMMENDATIONS.
- E. APPLY HEAT TRACE TO THE FOLLOWING PIPING SYSTEMS.
- (1) DOMESTIC WATER (COLD, HOT, RECIRC.) EXPOSED TO FREEZING
- CONDITIONS. (2) SANITARY TRAPS AND THE DOWNSTREAM HORIZONTAL PIPE WHERE
- EXPOSED TO FREEZING CONDITIONS.
- (3) STORM PIPING SUBJECT TO FREEZING CONDITIONS.
- F. ALL HEAT TRACE PIPE SHALL BE INSULATED PER SPECIFICATIONS. G. COORDINATE ALL HEAT TRACING AND REQUIRED CIRCUITS WITH
 - ELECTRICAL CONTRACTOR.

FIRE STOPPING:

1. FIRE STOPPING REQUIREMENT: PENETRATIONS THROUGH RATED WALLS AND FLOORS SHALL BE SEALED WITH A MATERIAL CAPABLE OF PREVENTING THE PASSAGE OF FLAMES AND HOT GASSES WHEN SUBJECTED TO THE REQUIREMENTS OF THE TEST STANDARD SPECIFIC FOR FIRE STOPS ASTM-E-814. ACCEPTANCE MATERIALS INCLUDE: DOW CORNING RTV FIRE STOP FOAM FOR BARE PIPE, METAL CONDUIT, AND ELECTRICAL CABLE; 3M FIRE DAM 150 CAULK FOR BARE PIPE, METAL CONDUIT, AND BUILDING CONSTRUCTION; GAPS 3M FS-195 INTUMESCENT STRIPS FOR INSULATED PIPES, PLASTIC PIPE OR CONDUIT, AND ELECTRICAL CABLE.

EQUIPMENT DESIGNATIONS



- INDICATES TYPE OF EQUIPMENT - INDICATES UNIT NUMBER WITHIN AREA

ADD ALTERNATES:

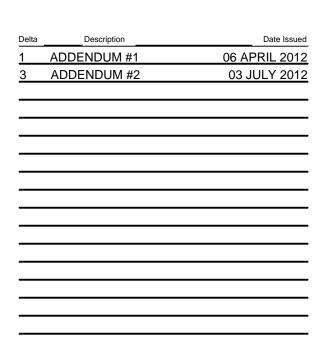
INSTALL NEW EVIDENCE CAGE AND ALL REQUIRED MECHANICAL. PLUMBING. ELECTRICAL & STRUCTURAL ITEMS AT EXISTING VEHICLE STORAGE. RE: DRAWINGS

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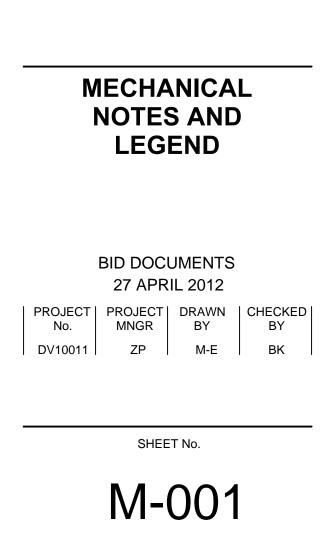
- INSTALL HEATING AND INSULATION AT EXISTING VEHICLE STORAGE WALLS AND ROOFS. RE: DRAWINGS
- INSTALL SKID-RESISTANT EPOXY FLOOR SEALER AT NEW GARAGE INTERIOR; COLOR TO BE SELECTED BY ARCHITECT
- INSTALL BUS DUCT; ELIMINATE DIRECT WIRE AND INSTALLATION OF 400A PANEL; RE: FI FC
- 5. PROVIDE 21" 'SOLATUBE' SKYLIGHTS; MODEL #750 DS-O OPEN CLG W/ LIGHT EXTERIOR INTERCEPTING TRANSFER DEVICE, EXTENSION TUBE, & INTERIOR LENS: PROVIDE

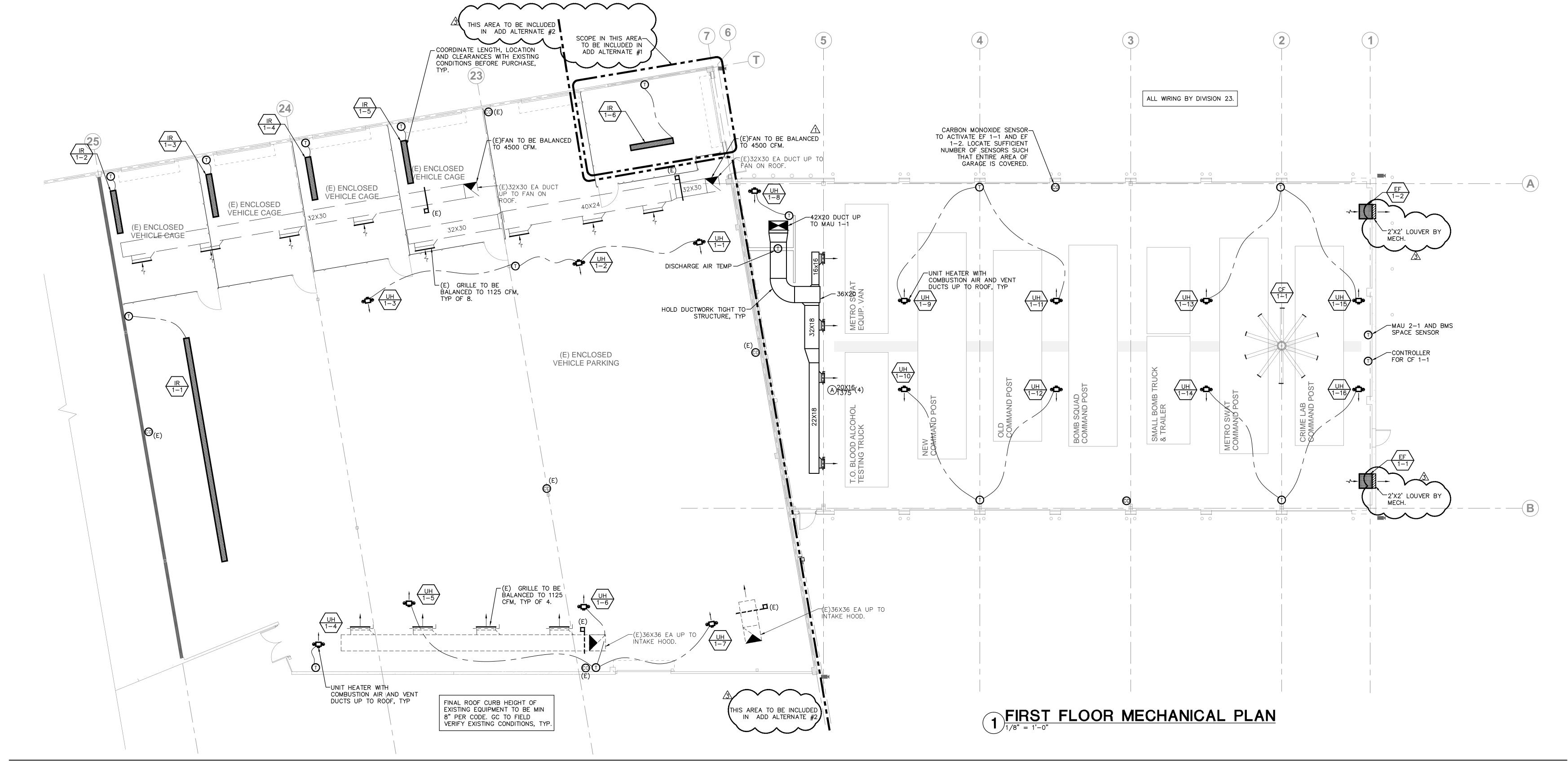
- STEEL FRAMED OPENINGS AS REQ'D: SEE PLAN FOR QTY. 6. PAINT ALL OVERHEAD STRUCTURE AND INTERIOR EXPOSED CONCRETE WALLS &
- COLUMNS AT NEW GARAGE; COLOR TO BE SELECTED BY ARCHITECT INSTALL INTERIOR LOOPS FOR GARAGE DOORS; SEE 1/A-101 FOR MORE INFO





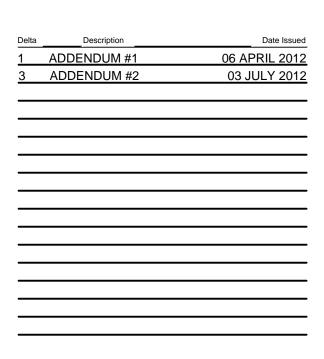


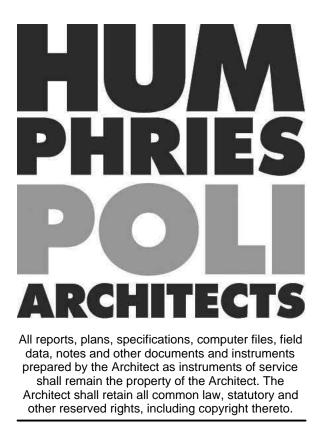




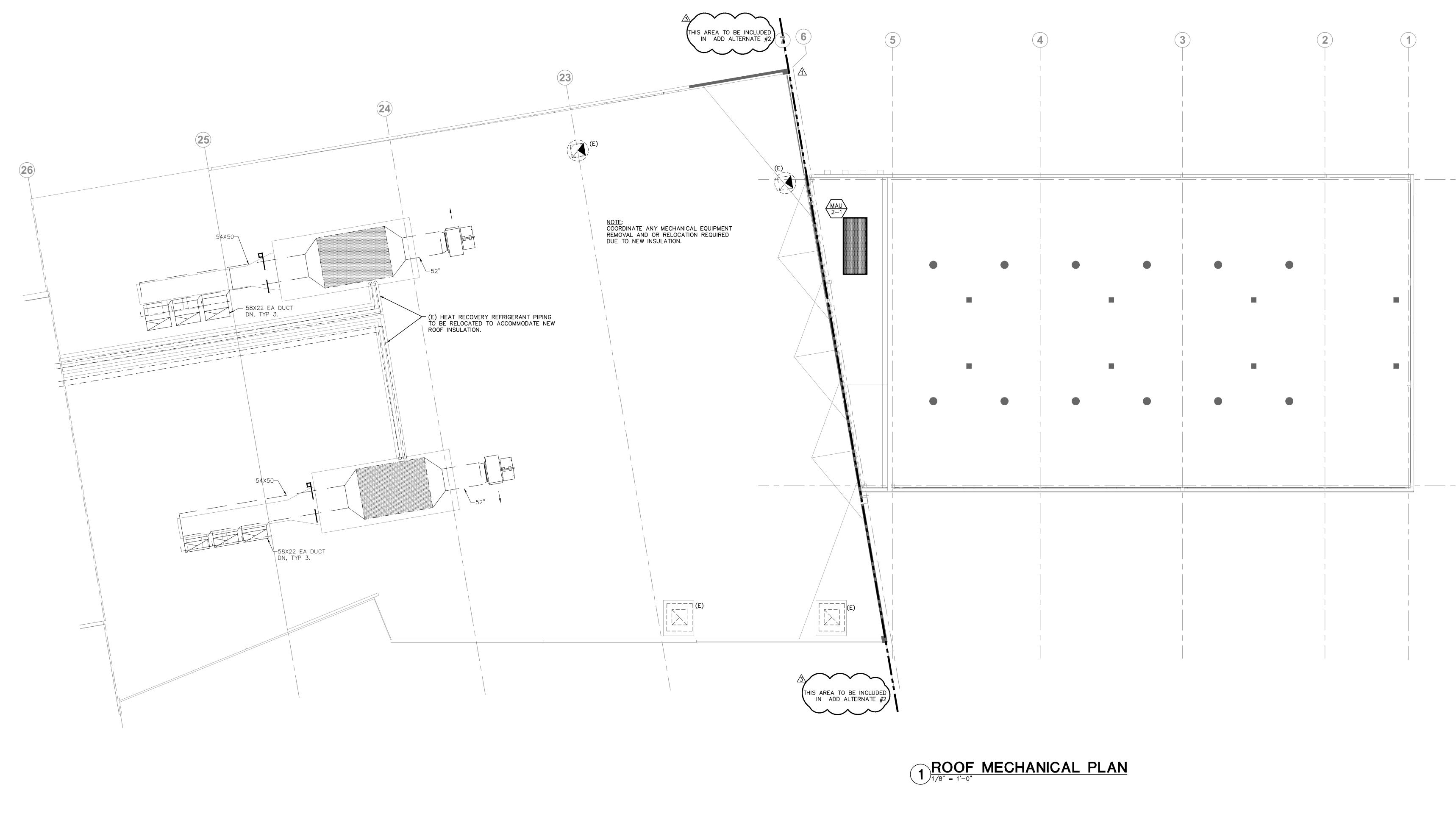
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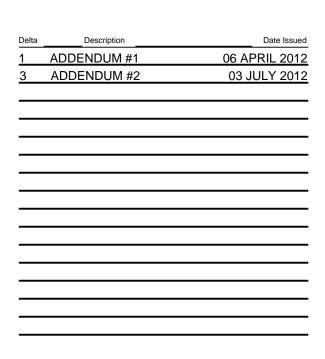




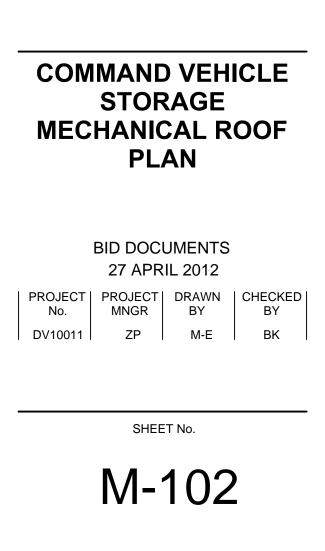










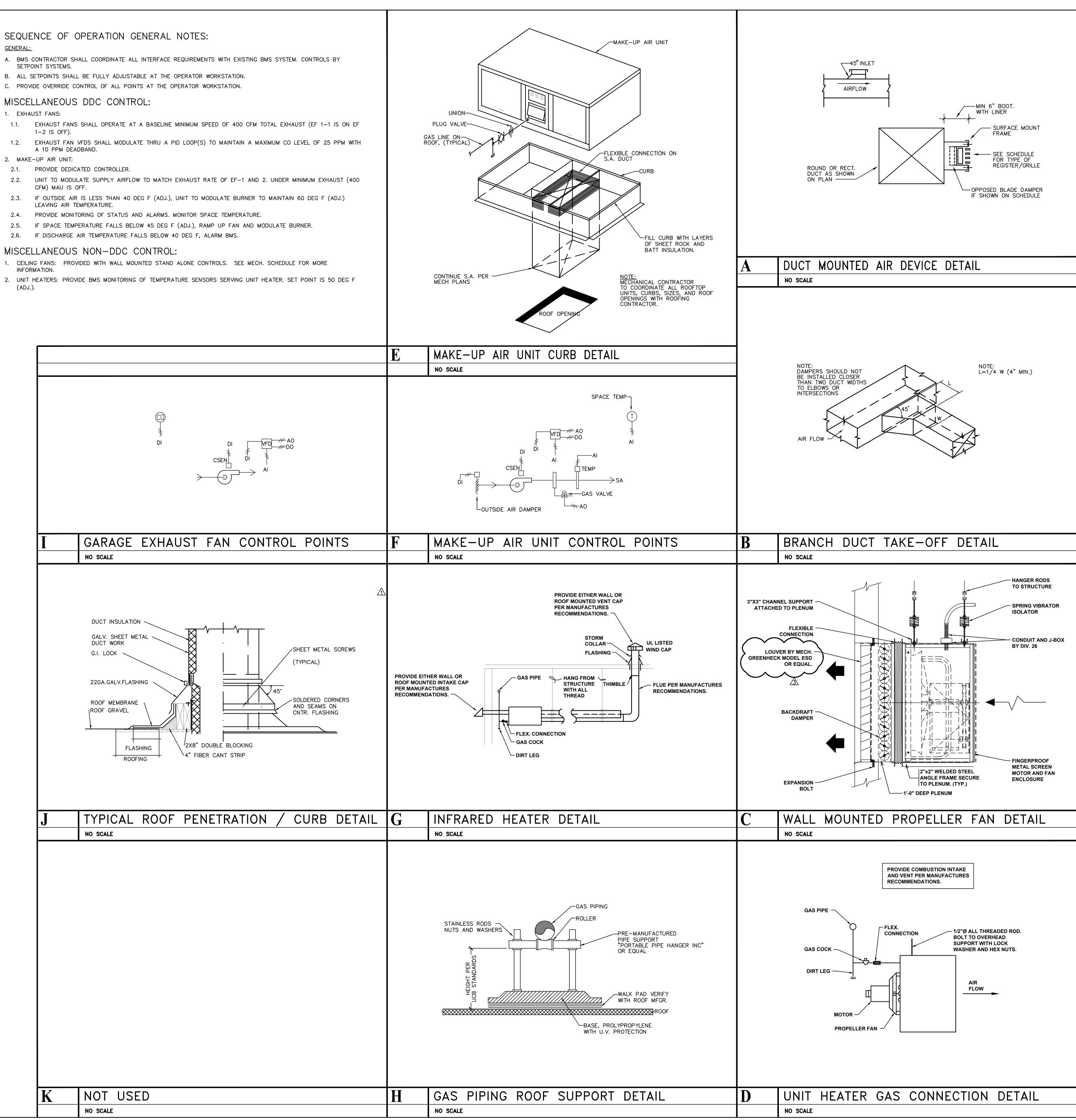


<u>GENERAL:</u>

- SETPOINT SYSTEMS.

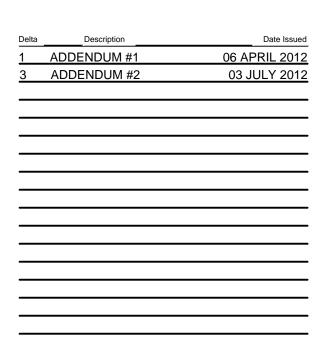
- MISCELLANEOUS DDC CONTROL:
- 1. EXHAUST FANS: 1–2 IS OFF). A 10 PPM DEADBAND. 2. MAKE-UP AIR UNIT: 2.1. PROVIDE DEDICATED CONTROLLER. CFM) MAU IS OFF.
- LEAVING AIR TEMPERATURE.
- MISCELLANEOUS NON-DDC CONTROL:
- INFORMATION.
- (ADJ.).

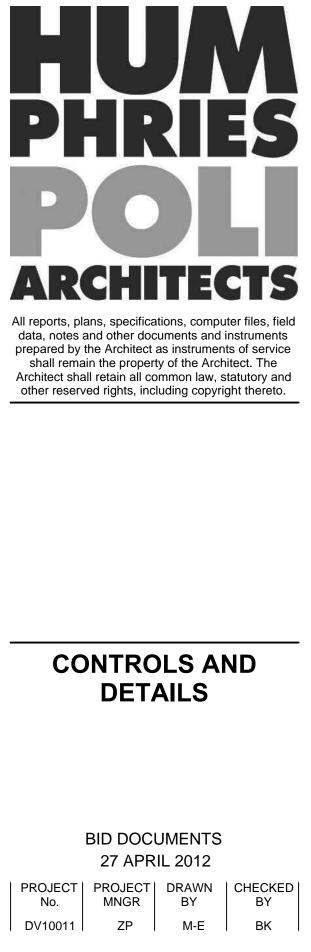
T	GAF
1	NO SC
	DUCI
	GALV DUC1
	DUCT G.I. L
	22GA
	ROOF
	ROOF
	_
J	TYP
0	NO SC
K	NOT





Denver Traffic Operations Command Vehicle Storage & Modifications 3501 Park Avenue Denver, CO 80216





SHEET No.

M-201

CODE	MANUFACTURER/		INPUT	REFLECTOR	CLI	EARANCES (IN)		ELEC	TRICAL		
(IR)	MODEL NO.	SERVICE	(MBH)	(FT)	ABOVE	BELOW	SIDE	HP	VOLT	PH	FLA	REMARKS
1–1	ROBERTS GORDAN VANTAGE II CTH2–125	LOADING DOCK	125	40	6	77	46		120	1	5	A, B, C
1-2	ROBERTS GORDAN CARIBE CGTH-30	LOADING DOCK	30	8	4	36	16		120	1	1	A, B
1–3	ROBERTS GORDAN CARIBE CGTH-30	LOADING DOCK	30	8	4	36	16		120	1	1	A, B
1-4	ROBERTS GORDAN CARIBE CGTH-30	LOADING DOCK	30	8	4	36	16		120	1	1	А, В
1–5	ROBERTS GORDAN CARIBE CGTH-30	LOADING DOCK	30	8	4	36	16		120	1	1	А, В
1-6	ROBERTS GORDAN CARIBE CGTH-30	LOADING DOCK	30	8	4	36	16		120	1	1	Α, Β
PROVI	L NOTES ITE ELEVATION = 5,300 FT. DE SHIELDING FOR EXISTING EQUIPMENT, PIPING, E ⁻ NATE MOUNTING AND CLEARANCES WITH EXISTING	TC. THAT DOES NOT ME		CLEARANCES.								

B. PROVIDE THERMOSTATS AND CONTROL PANELS (24V).

C. 40 FOOT STRAIGHT TUBE.

REMARK NOTES

A. ROUTE INTAKE AND VENT PER MANUFACTURERS RECOMENDATIONS. PROVIDE MANUFACTURER APPROVED INTAKE CAP AND EXHAUST CAP.

	CODE		
E		_	
E	F 1-2	-	
С	CF 1-1		BIG
GE 1.	NERAL DRIVE	ΤY	ΈE
3.	SCHE	BEI DUL ER/	.ED
4.	PROVI		M
5.	PROVI	DE	PF
1.	OUNTIN UNIT PROVI	то	BE
۱.	NTROL FAN O CONTF	PÈF	RA ⁻
А. В.	MARK PROV PROV PROV	IDE IDE	BE VF

		MAKE UF	P AIR	UNIT	SCHED	ULE (GAS)				
	MANUFACTURER/	AREA		ESP	CAPA	CITY (MBH)		ELEC	CTRICAL		
CODE	MODEL NO.	SERVED	CFM	(ALT.)(IN.)	INPUT (SL)	OUTPUT (ALT.)	ΗP	VOLT	PH	FLA	REMARKS
MAU 2-1	REZNOR RPBL-700	GARAGE	5,500	0.5	700	441	3	480	3	-	A, B, C
GENERAL N 1. PROVIDE	NOTES E FULL PERIMETER ROOF	CURB.									

2. PROVIDE PREMIUM EFFICIENCY MOTORS FOR MOTORS 1 HP AND OVER PER MENA STANDARD MG1-2003, TABLES 12-12 AND 12-13.

3. PROVIDE DUCT SMOKE DETECTOR IN ALL UNITS OVER 2000 CFM. RE: SPECIFICATIONS 4. PROVIDE FILTER SECTION WITH MERV 8 FILTERS.

5. PROVIDE VFD. 6. SCHEDULED FAN VALUES (CFM, SP AND HP) ARE ACTUAL AT ALTITUDE. MOTOR HP HAS BEEN ADJUSTED FROM SEA LEVEL CONDITIONS FOR OPERATION AT JOBSITE ELEVATION. JOBSITE ELEVATION = 5300FT.

REMARK NOTES

A. PROVIDE INTAKE HOOD WITH SCREEN, DOWNTURN PLENUM, INTAKE DAMPER, RELAY CONTACTS TO START EF, INSULATED CABINET AND 120V CONVINENCE OUTLET.

B. UNIT TO HAVE 4:1 TURNDOWN RATIO. C. PROVIDE VFD AND MODULATING BURNER

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CODE	MANUFACTURER/		INPUT	OUTPUT		EAT	LAT		ELECTR	RICAL	
(UH)	MODEL NO.	SERVICE	(MBH)	(MBH)	CFM	(F)	(F)	HP	МСА	VOLT	Ρ
1-1	REZNOR / MODEL B	GARAGE	165	104	2,715	50	110	1/2	9	120	Γ
1-2	REZNOR / MODEL B	GARAGE	165	104	2,715	50	100	1/2	9	120	
1-3	REZNOR / MODEL B	GARAGE	165	104	2,715	50	100	1/2	9	120	
1-4	REZNOR / MODEL B	GARAGE	165	104	2,715	50	100	1/2	9	120	
1-5	REZNOR / MODEL B	GARAGE	165	104	2,715	50	100	1/2	9	120	
1–6	REZNOR / MODEL B	GARAGE	165	104	2,715	50	100	1/2	9	120	Γ
1–7	REZNOR / MODEL B	GARAGE	165	104	2,715	50	100	1/2	9	120	Γ
1–8	REZNOR / MODEL B	WORK AREA	100	63	1,645	50	100	1/3	5.3	120	Γ
1-9	REZNOR / MODEL B	GARAGE	100	63	1,645	50	110	1/3	5.3	120	
1–10	REZNOR / MODEL B	GARAGE	100	63	1,645	50	100	1/3	5.3	120	
1-11	REZNOR / MODEL B	GARAGE	100	63	1,645	50	100	1/3	5.3	120	
1-12	REZNOR / MODEL B	GARAGE	100	63	1,645	50	100	1/3	5.3	120	
1–13	REZNOR / MODEL B	GARAGE	100	63	1,645	50	100	1/3	5.3	120	
1-14	REZNOR / MODEL B	GARAGE	100	63	1,645	50	100	1/3	5.3	120	
1–15	REZNOR / MODEL B	GARAGE	100	63	1,645	50	100	1/3	5.3	120	
1–16	REZNOR / MODEL B	GARAGE	100	63	1,645	50	100	1/3	5.3	120	Γ

2. PROVIDE UNITS WITH MODULATING GAS VALVE. 3. PROVIDE FLUE AND COMBUSTION INTAKE. UNITS TO BE SEPARATED COMBUSTION/INTAKE.

ENVIRONMENTAL FAN SCHEDULE

			,									
					ESP		E	ELECTRI	CAL			
MANUFACTURER/					"W.C.							
MODEL NO.	SERVICE	LOCATION	TYPE	CFM	(ALT.)	DRIVE	HP/W	VOLT	PH	MTG	CTRL	REMARKS
GREENHECK SBE-2H20	GARAGE EXHAUST	GARAGE	PROPELLER	2,750	0.35	В	1/2	120	1	1	I	А, В
GREENHECK SBE-2H20	GARAGE EXHAUST	GARAGE	PROPELLER	2,750	0.35	В	1/2	120	1	1	I	А, В
BIG ASS FANS / 14' POWERFOIL X	GARAGE DESTRATIFICATION	GARAGE	PROPELLER	-		D	1.5	460	3	2	II	С

PE: D=DIRECT-PROVIDE RHEOSTAT SPEED CONTROLLER IN FAN HOUSING UNLESS OTHERWISE NOTED.

-PROVIDE ADJUSTABLE SHEAVE UNLESS OTHERWISE NOTED. FAN VALUES (CFM, SP AND HP) ARE ACTUAL AT ALTITUDE. MOTOR HP HAS BEEN ADJUSTED FROM SEA LEVEL CONDITIONS FOR

ATION AT JOBSITE ELEVATION. JOBSITE ELEVATION = 5300FT. MAGNETIC STARTER WITH AUXILIARY CONTACTS AND HOA SWITCH ON ALL THREE PHASE UNITS EXCEPT WHEN

D FROM MOTOR CONTROL CENTER. PREMIUM EFFICIENCY MOTORS FOR MOTORS 1 HP AND OVER PER MENA STANDARD MG1-2003, TABLES 12-12 AND 12-13.

TG)

E MOUNTED TO GARAGE WALL. MANUFACTURER APPROVED MOUNTING SYSTEM. COORDINATE FINAL HEIGHT WITH ARCH.

TRL) ATED BY CARBON MONOXIDE SENSOR.

VIA FACTORY PROVIDED COMPACT WALL SWITCH WITH ABILITY TO ADJUST FAN SPEED. EACH FAN SHALL BE PROVIDED WITH ITS OWN CONTROLLER.

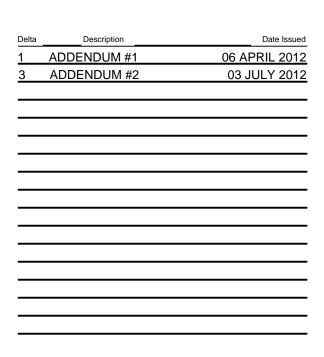
BELT AND MOTOR GUARD.

VFD, SHORT MOTOR HOUSING, FLUSH EXTERIOR W / OSHA GUARD, AND GRAVITY BACKDRAFT DAMPER. WITH MANUFACTURER PROVIDED WALL MOUNTED CONTROLLER. CONTROL WIRING BETWEEN CONTROLLER AND FAN SHALL BE BY DIVISION 26.

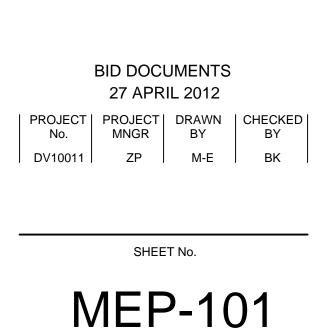
CODE	MANUFACTURER/ MODEL NO.	SERVICE	TYPE	ACCESSORIES	FACE SIZE	REMARKS
A	PRICE / 520	SUPPLY	LOUVERED	_	SEE PLANS	A
	S FOR CFM AND NECK SIZ	E. LL BE 30 UNLESS OTH	ERWISE NOTED.			
	BE COORDINATED WITH A					



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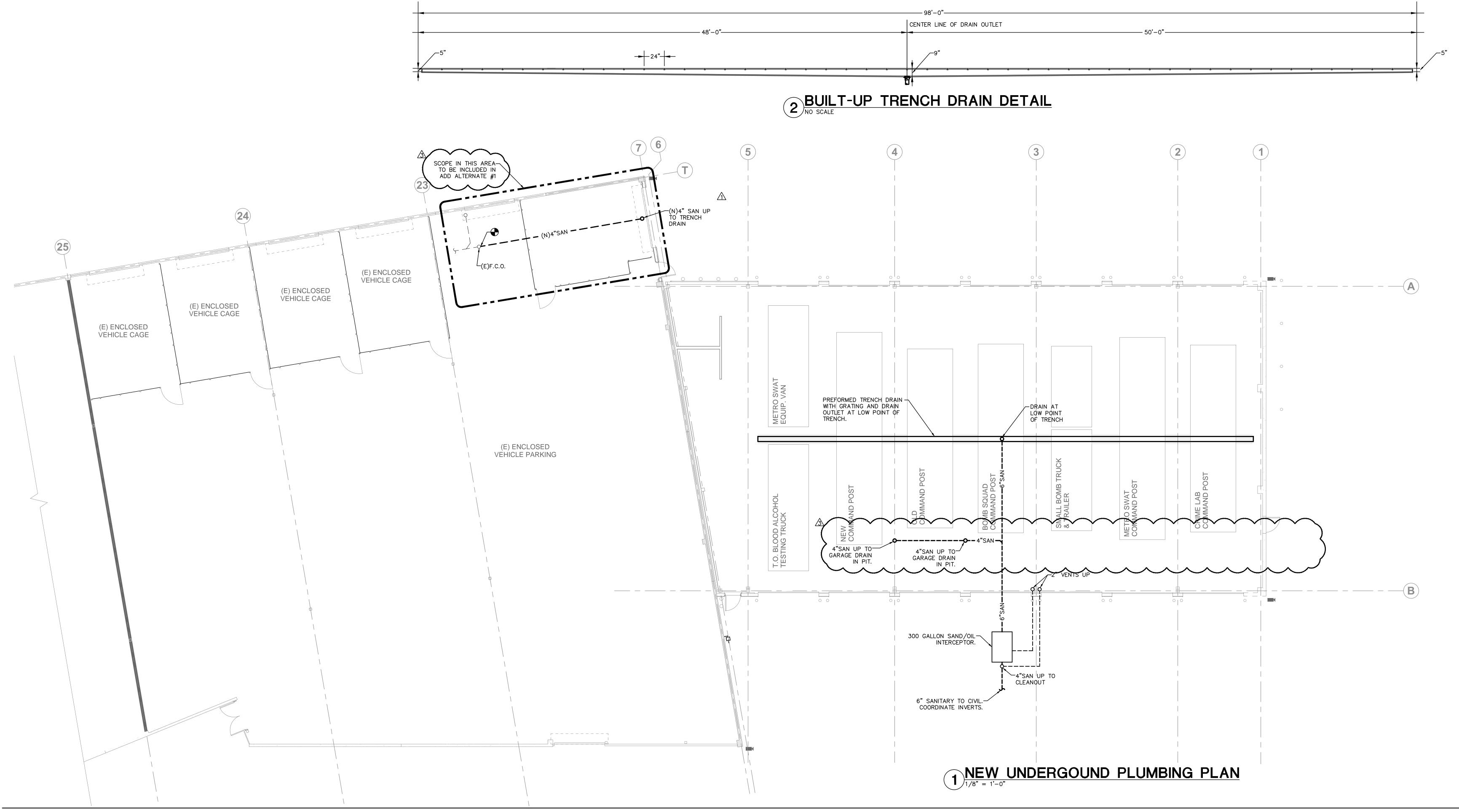


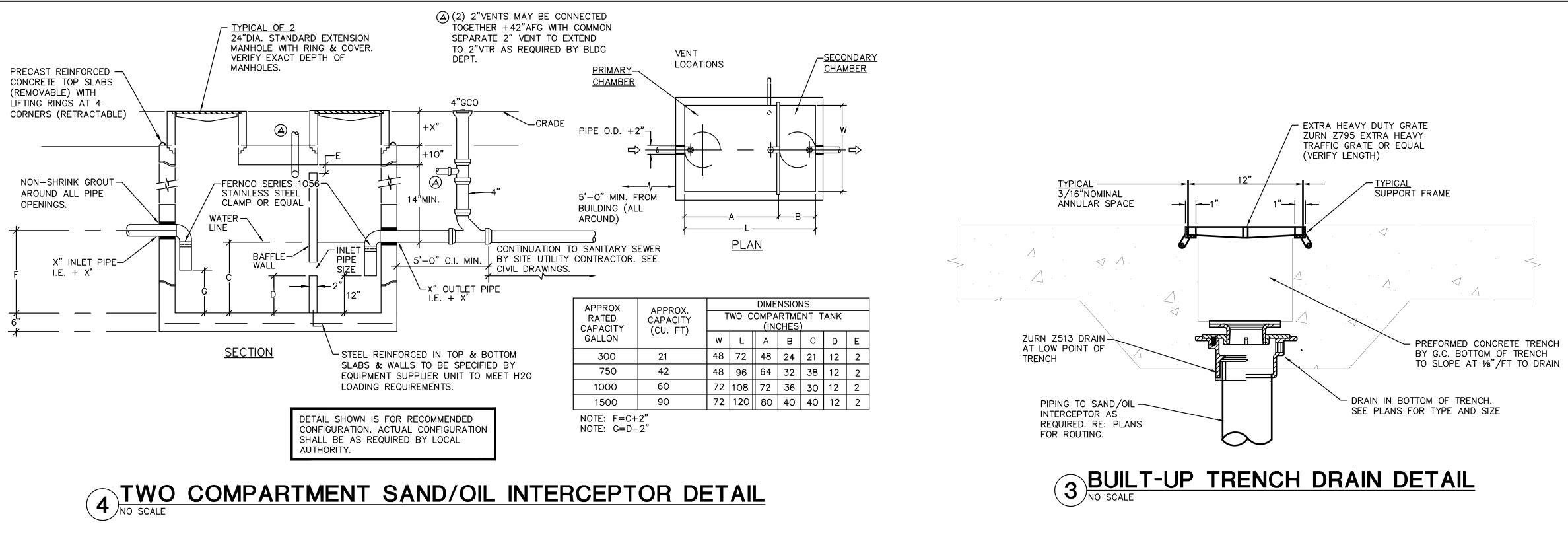


MECHANICAL

SCHEDULES

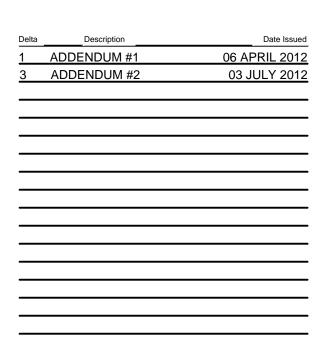








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P-100

						PLUM	BING FIXTL	JRE SCHEDULE		
CODE	FIXTURE	DESCRIPTION	LOCATION	MIN CW CONN.	MIN HW CONN.	MIN SAN CONN.	MIN VENT CONN.	MANUFACTURER & MODEL NO.	FAUCET/FLUSH VALVE	REMARKS
GD—1	GARAGE DRAIN	FLOOR DRAIN	ELECTRICAL PITS		l SIZES	AS NOTED		ZURN Z509-Z-P-Y WITH C.I. GRATE		D.C.C.I. BODY, GALV. C.I. GRATE
TD-1	TRENCH DRAIN	BUILT-UP TRENCH DRAIN	GARAGE		SIZES	AS NOTED		ZURN Z794 GRATING / ZURN Z513 DRAIN		H20 LOADING REQUIREMENT FOR TENCH AND GRATE
TD-2	TRENCH DRAIN	TRENCH DRAIN	GARAGE	_	-	4"	_	JAY R. SMITH ENVIRO-FLO SERIES 9931		PRE-SLOPED SECTIONS WITH 4" OUTLET AND H20 LOADING REQ. FOR TRENCH AND GRA
WH—1	WALL HYDRANT	RECESSED, MODERATE CLIMATE	GARAGE	3/4"				ZURN Z1330		ANTI-SIPHON, OPERATING KEY LOCK, AUTO DRAINING, INTEGRAL BACKFLOW PREVENTER

3. ALL FIXTURE ARE WHITE UNLESS OTHERWISE NOTED.

DEFINITIONS:		
ADA — AMERICANS AS — ANTISCALD	WITH	DISABI
AS – ANTISCALD		

BO – BOTTOM OUTLET CT – COUNTER TOP

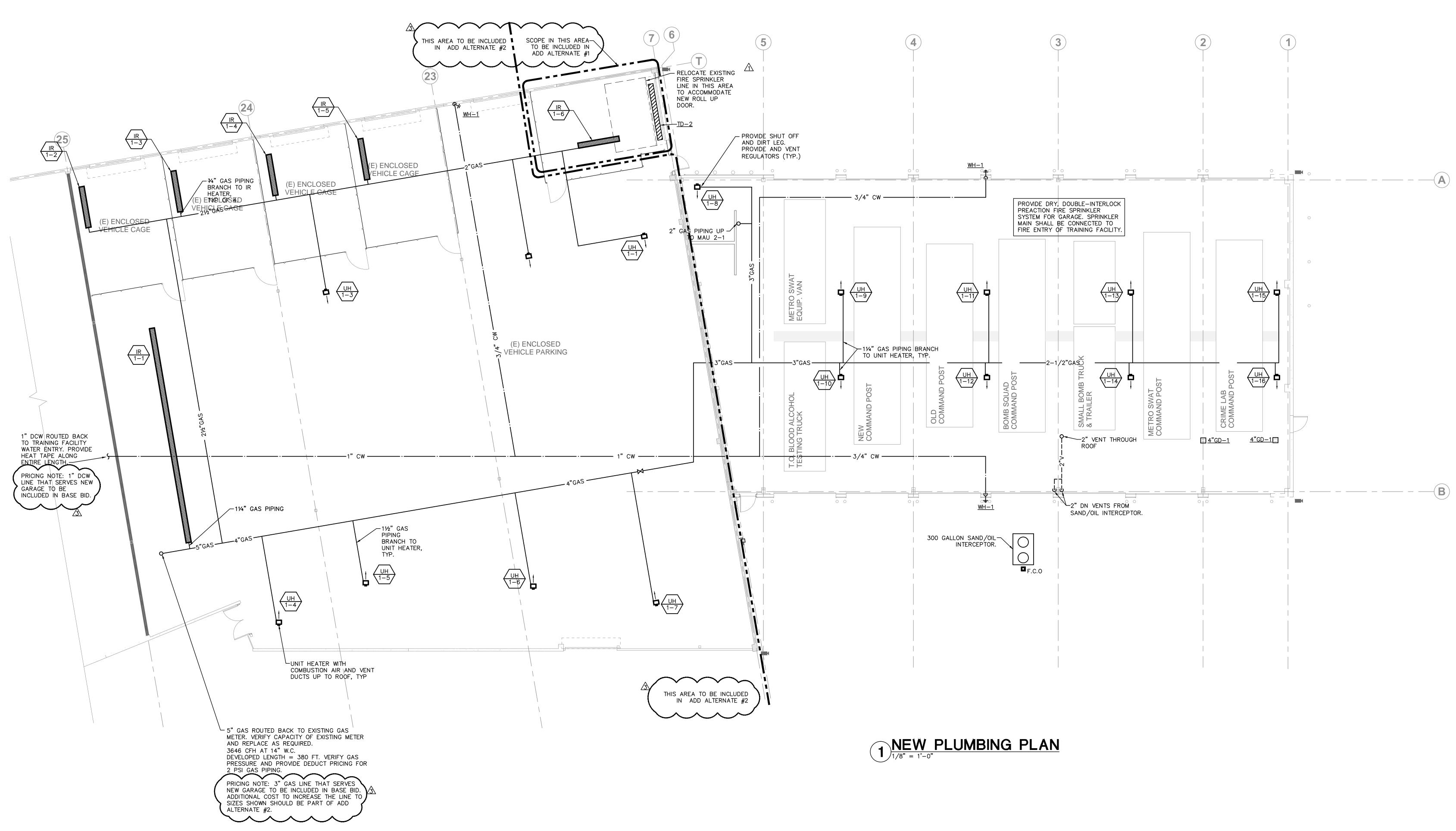
EB – ELONGATED BOWL

EBF - ELECTRONIC, BATTERY OPERATED FAUCET EBFV – ELECTRONIC, BATTERY OPERATED FLUSH VALVE

FC – FLASHING CLAMP FM - FLOOR MOUNTED

FP – FREEZE PROOF

FR - FLOW RESTRICTOR FT – TANK FV – FLUSH VALVE



PLUMBING DESIGN AND SIZES ARE BASED ON THE 2009 INTERNATIONAL PLUMBING CODE W/DENVER AMENDMENTS 2. ALL EXPOSED PIPING SERVING PLUMBING FIXTURES THAT MAY BE USED FOR ADA PURPOSES SHALL TRAPS AND SUPPLIES INSULATED PER ADA REQUIREMENTS.

BILITIES ACT APPROVED

HH – HAND HELD SHOWER MV – MIXING VALVE MF - METERING FAUCET

PB – PRESSURE BALANCING PTB – PRESSURE – TEMPERATURE BALANCED

PES – PORCELAIN ENAMELED STEEL

S - SOLID WHITE ELONGATED OPEN FRONT SEAT, LESS COVER WITH CHECK HINGE SC - SOLID WHITE ELONGATED OPEN FRONT SEAT WITH COVER

SS – STAINLESS STEEL VB – VACUUM BREAKER

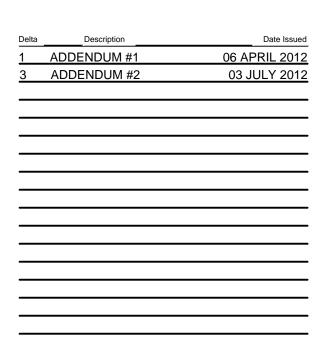
VC – VITREOUS CHINA VR – VANDAL RESISTANT

WC – WALL FIXTURE CARRIER

WH – WALL HUNG

WO - WALL OUTLET









	PANEL "MDP" (EXISTIN	IG)		-	V	OLTAGE	277	. /	480	V	3	ø	4 W	
	FLUSH	MAIN	1200/3	GF		MLO	X							
		BUS	1200A	-	FEE	d thru			-	A.I.C.	42,000			
TYPE	DESCRIPTION	BKR	CIR		LOAD (VOLT AN	(PS) /	PHASE		CIR	BKR		DESCRIPTION	T
				A		В		c						
RMKG	PANEL "SDPOPS"	300 /	1	74394	0					2		UNUSAB	LE SPACE	
RMKG	-		3			60251	0			4		UNUSAB	LE SPACE	
LRMK	-	3	5					58761	0	6		UNUSAB	LE SPACE	
RMKG	PANEL "SDPFR"	600 /	7	134064	0					8		UNUSAB	LE SPACE	\bot
RMKG	-		9			135586	0			10		UNUSAB	LE SPACE	
LRMG	_	3	11					130680	0	12		UNUSAB	LE SPACE	
М	"RTU 1-1"	175	13	24664	24664			,		14	175 /	"RTU 1-	-2"	
М	-		15	1		24664	24664			16		-		╇
М	-	/ 3	17		i	1		24664	24664	18	/ 3			╇
L	PANEL "EMH"	100	19	4916	33681			1		20	225 /	PANEL	"H1A"	F
L	-	\downarrow	21	4		5600	30195			22		-		L
L	-	3	23		1			2560	32576	24	/ 3			L
G	TVSS	60	25	50	34236		1	1		26	250/	PANEL	"HLVS"	L
G	-		27	-		50	37260			28		-		
G	_ 	/ 3	29			ı		50	33800		/ 3			L
	200A SPACE		31	0	0			1		32		200ASP/	ACE	╀
	-		33	-		0	0		<u> </u>	34		-		╇
	-		35	770000		740070		0	0	36		-		
				330669		318270		307755						
	LOAD TYPE		CON) KVA	тот	'AL	FACT	OR	DE	MAND	KVA	TOTAL	٦
			A	В	С	ALL P	HASES			A	В	C	ALL PHASES	
	LIGHTING		29.7	27.4	20.0	77.1		125%		37.1	34.3	25.0	96.4	
	RECEPTACLE (10KVA O	r less)	3.3	3.3	3.3	10.0		100%		3.3	3.3	3.3	10.0	7
	RECEPTACLE (OVER 10		57.5	48.2	50.7	156.4		50%		28.7	24.1	25.4	78.2	1
			178.1	173.8	174.6	526.5		100%		178.1		174.6	526.5	1
	MOTOR(LARGEST)		24.0	24.0	24.0	72.0		125%		30.0	30.0	30.0	90.0	1
	KITCHEN EQUIPMENT		6.0	6.1	4.8	16.9		65%		3.9	4.0		11.0	-
												3.1		-
	MISCELLANEOUS		32.1	35.4	30.4	97.9		100%		32.1		30.4	97.9	-
	TOT	FAL KVA	330.7	318.3	307.8	956.7			AL KVA				909.9	4
	WITH GROUND BUS							TOTAL	. AMPS	1130.9	1100.6	1053.1	1094.4	
	LEGEND L = LIG	HTING	R =	RECEPT	ACLE	M =	HVAC /	MOTOR	к	= KITCH	IEN	G = MI	SCELLANEOUS	

_																
		PANEL <u>"HLVS" (NEW)</u>			_	VC	DLTAGE	277	/_	480	V	3	ø	4	w	
		FLUSH	MAIN	250/3	_		MLO									
			BUS	250A	_	FEED					A.I.C.	14,000	A			
					-											
ŀ	TYPE	DESCRIPTION	BKR	CIR		LOAD	(VOLT A	MPS) /	/ PHASE	:	CIR	BKR		DESC	RIPTION	TYPE
					A		B		C							
	L	WALL LTG	20	1	776	0					2	20	SPARE			
	L	CLG LTG	20	3			1536	0			4	20	SPARE			
L	L	CLG LTG	20	5					1536	0	6		SPACE			
L	M	MAU-2-1	15	7	1330	0	<u> </u>		1		8		SPACE			
	M	-		9	-		1330	0			10		SPACE			
	M	-	3				1		1330	0	12		SPACE			
ŀ	<u>M</u>	CF-1-1	15	13	942	0			1		14		SPACE			
┝	<u>M</u>	-	-	15	-		942	0	040		16		SPACE			
┝	M	- SPACE	3	17 19	0		1		942	0	18 20		SPACE SPACE			
F		SPACE		21		0	0	0	1		20		SPACE			
ŀ		SPACE		23				0	0	0	24		SPACE			
F		SPACE		25	0	0	1		U	0	24		SPACE			
F		SPACE		27		•	0	0			28		SPACE			
F		SPACE		29					0	0	30		SPACE			
F		SPACE		31	0	0]				32		SPACE			
		SPACE		33			0	0			34		SPACE			
		SPACE		35					0	0	36		SPACE			
	RMG	SUBFEED	225 /	37	31188	0					38		SPACE			
L	RMG	-		39			33452	0			40		SPACE			
L	RMG	150 KVA TRANSFORMER	3	41					29992	0	42		SPACE			
					34236		37260		33800		J					
		LOAD TYPE		CON	NECTEL) KVA	TO	TAL	FACT	OR	DE	MAND	KVA	٦	TOTAL	-
				A	В	С	ALL F	PHASES			A	В	C	ALL	PHASES	
		LIGHTING		0.8	1.5	1.5	3.8		125%		1.0	1.9	1.9		4.8	
		RECEPTACLE (10KVA OF	r less)	0.5	1.1	1.6	3.2		100%		0.5	1.1	1.6		3.2	
		RECEPTACLE (OVER 10	KVA)	0.0	0.0	0.0	0.0		50%		0.0	0.0	0.0		0.0	
		HVAC/MOTOR		10.6	9.7	9.7	30.1		100%		10.6	9.7	9.7		30.1	
		MOTOR(LARGEST)		1.3	1.3	1.3	3.9		125%		1.6	1.6	1.6		4.9	
		KITCHEN EQUIPMENT		0.0	0.0	0.0	0.0		100%		0.0	0.0	0.0		0.0	
		MISCELLANEOUS		21.0	23.6	19.6	64.2		100%		21.0	23.6	19.6		64.2	
		тот	AL KVA	34.2	37.3	33.8	105.3		TOTA	l kva	34.8	38.0	34.5	10	07.2	4
1		WITH GROUND BUS							TOTAL	AMPS	125.5	137.1	124.6	12	29.0	
l		LEGEND L = LIG	hting	R =	RECEPT	ACLE	M = H	VAC /	MOTOR	к	= KITCH	IEN	G = M	SCELLAN	EOUS	
L		1														1

* INSTALL IN SUB-FEED SPACE.

				_w	4	ø	3	V .	208				VC	-				PANEL <u>"LLVS</u> "	
										-		MLO		-	100/3	MAIN	-	FLUSH	
				_			10,000/	A.I.C.	_) THRU	FEEC	-	100A	BUS	_		
Έ	TYP		I							•									
; DF	G		TYPE	TION	DESCRIP		BKR	CIR		<u> </u>	AMPS)	l –			CIR	BKR	N	DESCRIPTION	MPE
	G					DECEDTE	20	0		<u> </u>		B	540	A 200	•	20			G
	G	-	R R			RECEPTS RECEPTS		2 4		1	1080	300	340	200	<u>1</u> 3	20		CARD READER	
	G		R			RECEPTS	20	6	540	1176	1000				5	20		EF-1-1	
; DF	G		M			OVERHEAD		8	1 340			1	1176	1176	7	20		EF-1-2	
	G		M			OVERHEAD		10		1	1176	300	1170	1170	9	20		CF-1-1	
; IN:	G		M			OVERHEAD		12	1176	300	1170				11	20		CF-1-2	
	G		M			OVERHEAD		14	111/0			1	1176	864	13	20		UH-1-1	
; DF	G		M			OVERHEAD		16]	1176	864			15	20		UH-1-2	
			M			OVERHEAD		18	1176	864					17	20		UH-1-3	
; DF	G		M			OVERHEAD		20	1]	1176	864	19	20		UH-1-4	
; DF	G		M			OVERHEAD		22]	1176	864			21	20		UH-1-5	
			M			OVERHEAD		24	1176	864					23	20		UH-1-6	M
; DF	G		M		D DOOR	OVERHEAD		26]	1176	864	25	20		UH-1-7	M
; DF	G		M			OVERHEAD		28]	1176	864			27	20		UH-1-8	м
			M			OVERHEAD		30	1176	864					29	20		UH-1-9	М
; DF	G	1	M			OVERHEAD		32	•				1176	0	31			SPACE	
; DR	\ <u> </u>	/3	M		D DOOR	OVERHEAD	20	34			1176	0			33			SPACE	
	<u>`</u>	F	R	\sim		RECEPTS	20	36	1080	0			\sim		35			SPACE	
		G	G		VCE	HEAT TRA	20	38	-				500	0	37			SPACE	
; DF	G		3	\sim	\sim	SPARE	20	40		\sim	0	0			39			SPACE	
						SPARE	20	42	0	0					41			SPACE	
_										10392		10152		10888					
			_	TAL	тот	(VA	MAND	DE	TOR	FAC	TAL	т) KVA	INECTE	CON		D TYPE	LOA	
LI				HASES	ALL P	С	В	A		5	PHASES	ALL	с	В	A				
R				0	0.0	0.0	0.0	0.0		125%		0.0	0.0	0.0	0.0			LIGHTING	
R				2	3.2	1.6	1.1	0.5		100%		3.2	1.6	1.1	0.5	R LESS)	okva or	RECEPTACLE (1	
н				0	0.0	0.0	0.0	0.0		50%		0.0	0.0	0.0	0.0	(VA)	VER 10K	RECEPTACLE (O	
м				.1	26.	8.8	8.8	8.5		100%		26 .1	8.8	8.8	8.5			HVAC/MOTOR	
к				4	1.4	0.0	0.0	1.4		125%		1.1	0.0	0.0	1.1		r)	MOTOR(LARGEST	
м				0	0.0	0.0	0.0	0.0		100%		0.0	0.0	0.0	0.0		MENT	KITCHEN EQUIPI	
				0	1.(0.0	0.3	0.7		100%		1.0	0.0	0.3	0.7		;	MISCELLANEOUS	
w				7	31.7	10.4	10.2	11.2	AL KVA	тот		31.4	10.4	10.2	10.9	AL KVA	TOT		
				0	88.0	86.6	84.6	93.0	. AMPS	TOTA							S	WITH GROUND BUS	
]		CELLANEOU			= КПСН			HVAC /	M =	ACLE	RECEPT	R =	HTING	L = LIGH	LEGEND	

	PANEL	"LLVS2	2" (NEW)					
BASE-BID	PANEL.	if bid	ALTERNATE	# 4	IS	ACCEPTE	D,	

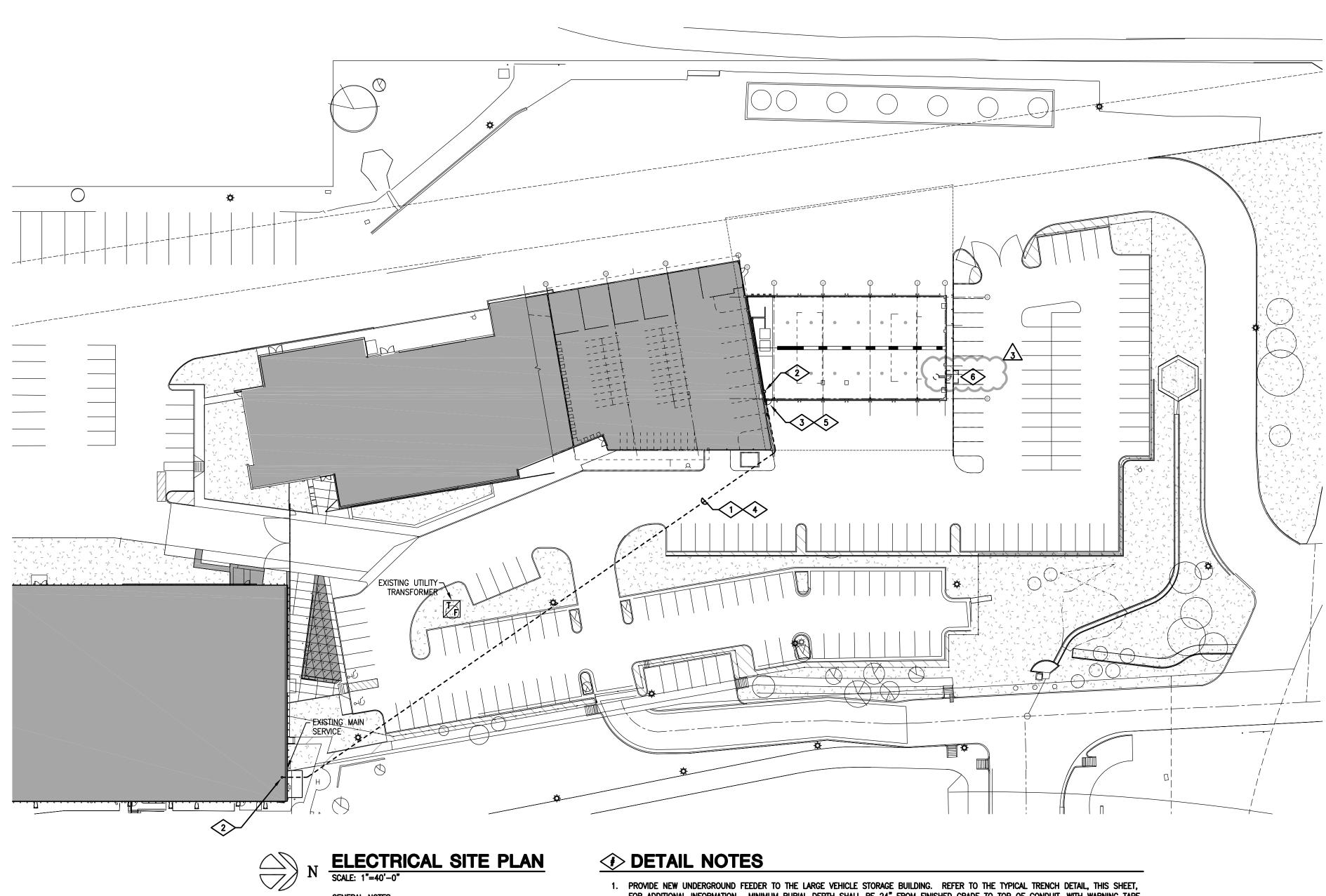
	TRANSFORMER	LOAD		-	VC	OLTAGE 120	/ 208	V	3	ø	<u>4</u> W	
YPE	DESCRIPTION	BKR	CIR		LOAD	(VOLT AMPS)	/ PHASE	CIR	BKR		DESCRIPTION	TYPE
				A		В	С					
G	400A BUSWAY/LLVS2	400 /		20300	10388		1		100 /	PANEL '	"LLVS"	RMG
G	-	\perp				23300 10152				-		RMG
G	-	3		30688		33452	19600 10392 29992		/ 3	-		RM
	LOAD TYPE			NECTED		TOTAL	FACTOR		MAND		TOTAL	1
			A	В	С	ALL PHASES		A	В	C	ALL PHASES	-
	LIGHTING		0.0	0.0	0.0	0.0	125%	0.0	0.0	0.0	0.0	
	RECEPTACLE (10KVA C	R LESS)	0.5	1.1	1.6	3.2	100%	0.5	1.1	1.6	3.2	
	RECEPTACLE (OVER 10	KVA)	0.0	0.0	0.0	0.0	50%	0.0	0.0	0.0	0.0	
	HVAC/MOTOR		9.6	8.8	8.8	27.2	100%	9.6	8.8	8.8	27.2	
	MOTOR(LARGEST)		0.0	0.0	0.0	0.0	125%	0.0	0.0	0.0	0.0	
	KITCHEN EQUIPMENT		0.0	0.0	0.0	0.0	100%	0.0	0.0	0.0	0.0	
	MISCELLANEOUS		20.5	23.6	19.6	63.7	100%	20.5	23.6	19.6	63.7	
	то	TAL KVA	30.7	33.5	30.0	94.1	TOTAL KVA	30.7	33.5	30.0	94.1	
	WITH GROUND BUS						TOTAL AMPS	255.7	278.8	249.9	261.3	1

G PROVIDE GFI BREAKER.

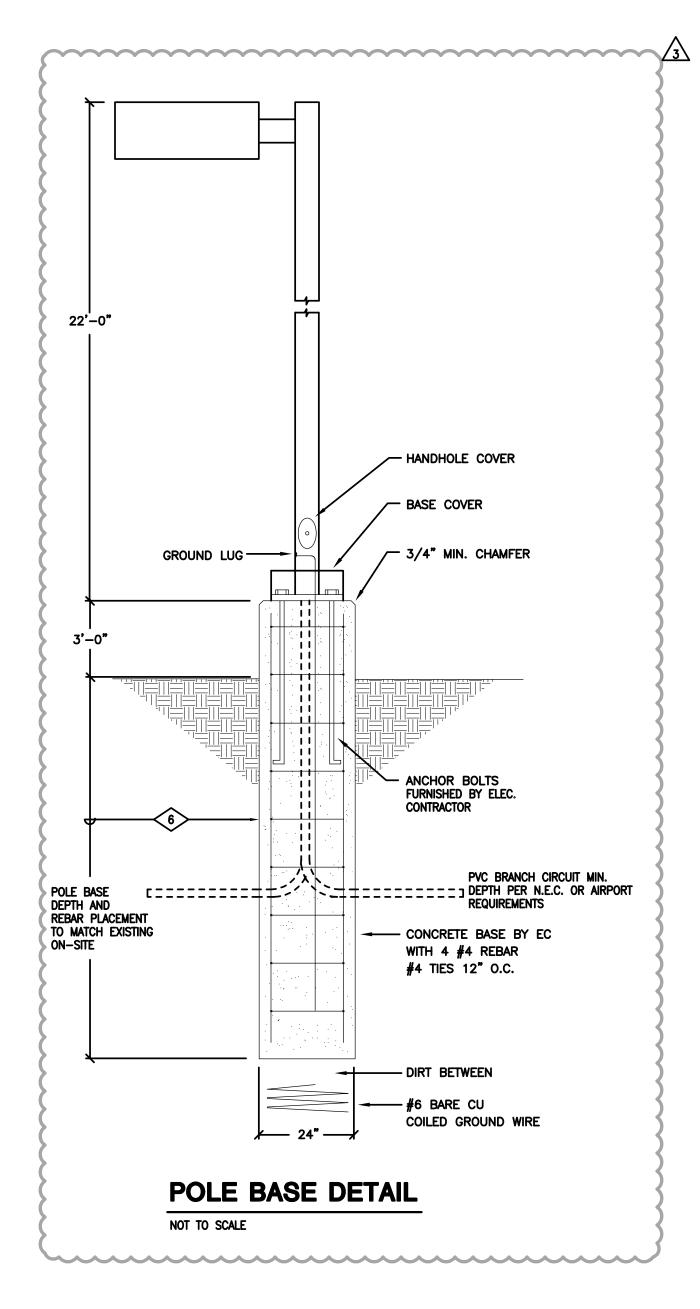
~~~~<u>}</u>

| BASE-E | ID PANEL. IF BID ALTERNA   |         |        |         |       |        |          |          |        |         |          |       |              |        |
|--------|----------------------------|---------|--------|---------|-------|--------|----------|----------|--------|---------|----------|-------|--------------|--------|
|        | PANEL <u>"LLVS2" (NEW)</u> |         |        |         | VC    | OLTAGE | 120      | . / .    | 208    | V       | 3        | ø     | ¥_₩          |        |
|        | FLUSH                      | MAIN    | 400/3  |         |       | MLO    |          |          |        |         |          |       |              |        |
|        | SURFACE X                  | BUS     | 400A   |         | FEED  | ) thru |          |          |        | A.I.C.  | 10,000/  | A     |              |        |
| TYPE   | DESCRIPTION                | BKR     | CIR    |         |       | 1      | MPS) /   |          |        | CIR     | BKR      |       | DESCRIPTION  | TYPE   |
|        |                            |         |        | A       |       | B      |          | <u>с</u> |        |         |          |       |              |        |
| G      | DROP CORD                  | 50      | 1      | 3500    | 3500  | 3500   | 3500     |          |        | 2       | 50       | DROP  | CORD         | G      |
| G<br>G | DROP CORD                  | 2<br>50 | 3<br>5 |         |       | 3300   | 3300     | 3500     | 2300   | 4<br>6  | 30 /     | DROP  |              | G<br>G |
| G      |                            | 2       | 7      | 3500    | 2300  | ]      |          | 5500     | 2300   | 8       | 20/2     | DROP  | CORD         | G      |
| G      | DROP CORD                  | 30 /    | 9      | 5500    | 2000  | 2300   | 3500     |          |        | 10      | 50 /     | DROP  | CORD         | G      |
| G      |                            | 2       | 11     |         |       | 2000   | 0000     | 2300     | 3500   | 12      |          | -     |              | G      |
| G      | IN-FLOOR VAULT             | 100     | 13     | 7500    | 0     | ]      | l        | 2000     | 0000   | 14      | <u> </u> | SPACE |              |        |
| G      | -                          |         | 15     |         |       | 7500   | 0        |          |        | 16      |          | SPACE |              |        |
| G      | DROP CORD RECP             | 20      | 17     |         |       |        | -        | 1000     | 1000   | 18      | 20       |       | CORD RECP    | G      |
|        | SPACE                      |         | 19     | 0       | 0     | ]      |          |          |        | 20      |          | SPACE |              |        |
| G      | DROP CORD RECP             | 20      | 21     |         |       | 1000   | 0        |          |        | 22      |          | SPACE |              |        |
| G      | DROP CORD RECP             | 20      | 23     |         |       |        |          | 1000     | 1000   | 24      | 20       | DROP  | CORD RECP    | G      |
|        | SPACE                      |         | 25     | 0       | 0     |        |          |          |        | 26      |          | SPACE |              |        |
| G      | DROP CORD RECP             | 20      | 27     |         |       | 1000   | 0        |          |        | 28      |          | SPACE |              |        |
| G      | DROP CORD RECP             | 20      | 29     |         |       |        |          | 1000     | 1000   | 30      | 20       | DROP  | CORD RECP    | G      |
|        | SPACE                      |         | 31     | 0       | 0     |        |          |          |        | 32      |          | SPACE |              |        |
| G      | DROP CORD RECP             | 20      | 33     |         |       | 1000   | 0        |          |        | 34      |          | SPACE |              |        |
| G      | DROP CORD RECP             | 20      | 35     |         |       | •      |          | 1000     | 0      | 36      |          | SPACE |              |        |
|        | SPACE                      |         | 37     | 0       | 0     |        |          | 1        |        | 38      |          | SPACE |              |        |
|        | SPACE                      |         | 39     |         |       | 0      | 0        |          |        | 40      |          | SPACE |              |        |
| G      | DROP CORD RECP             | 20      | 41     |         |       |        |          | 1000     | 0      | 42      |          | SPACE |              |        |
|        |                            |         |        | 20300   |       | 23300  |          | 19600    |        |         |          |       |              |        |
|        | LOAD TYPE                  |         | CON    | INECTED | ) KVA | TO     | TAL      | FAC      | TOR    | DE      | MAND     | KVA   | TOTAL        | 1      |
|        |                            |         | A      | В       | С     | ALL    | PHASES   |          |        | A       | В        | С     | ALL PHASES   |        |
|        | LIGHTING                   |         | 0.0    | 0.0     | 0.0   | 0.0    |          | 125%     |        | 0.0     | 0.0      | 0.0   | 0.0          |        |
|        | RECEPTACLE (10KVA O        | r Less) | 0.0    | 0.0     | 0.0   | 0.0    |          | 100%     |        | 0.0     | 0.0      | 0.0   | 0.0          |        |
|        | RECEPTACLE (OVER 10        | (VA)    | 0.0    | 0.0     | 0.0   | 0.0    |          | 50%      |        | 0.0     | 0.0      | 0.0   | 0.0          |        |
|        | HVAC/MOTOR                 |         | 0.0    | 0.0     | 0.0   | 0.0    |          | 100%     |        | 0.0     | 0.0      | 0.0   | 0.0          |        |
|        | MOTOR(LARGEST)             |         | 0.0    | 0.0     | 0.0   | 0.0    |          | 125%     |        | 0.0     | 0.0      | 0.0   | 0.0          |        |
|        | KITCHEN EQUIPMENT          |         | 0.0    | 0.0     | 0.0   | 0.0    |          | 100%     |        | 0.0     | 0.0      | 0.0   | 0.0          |        |
|        | MISCELLANEOUS              |         | 20.3   | 23.3    | 19.6  | 63.2   |          | 100%     |        | 20.3    | 23.3     | 19.6  | 63.2         |        |
|        | TOI                        | AL KVA  | 20.3   | 23.3    | 19.6  | 63.2   |          | TOTA     | NL KVA | 20.3    | 23.3     | 19.6  | 63.2         |        |
|        | with ground bus            |         |        |         |       |        |          | TOTAL    | AMPS   | 169.2   | 194.2    | 163.3 | 175.4        |        |
|        | Legend L = Lig             | HTING   | R =    | RECEPT  | ACLE  | M = 1  | ivac / I | MOTOR    | K      | = Kitch | ien      | G = M | ISCELLANEOUS |        |

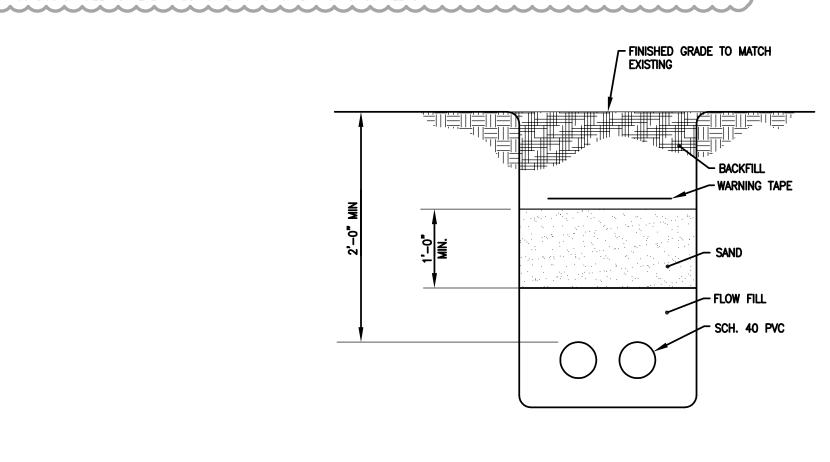
|          | PLUG-IN BUS         | DUCT    |      |        | VC    | LTAGE  | 120    | 1                | 208   | V       | 3      | ø     |      | 4 W               |      |
|----------|---------------------|---------|------|--------|-------|--------|--------|------------------|-------|---------|--------|-------|------|-------------------|------|
|          | <u></u>             |         | 400A |        |       |        |        | ,                |       |         | 10,000 |       |      |                   |      |
| TYPE     | DESCRIPTION         | BKR     |      |        | LOAD  | VOLT A | MPS),  | / PHAS           | E     |         | BKR    |       | DES  | SCRIPTION         | TYPE |
|          |                     |         |      | A      |       | В      |        | С                |       |         |        |       |      |                   |      |
| G        | DROP CORD           | 50      |      | 3500   | 3500  |        |        | •                |       |         | 50 /   | DROP  | CORD |                   | G    |
| G        | -                   | 2       |      |        |       | 3500   | 3500   |                  |       |         | 2      | -     |      |                   | G    |
| G        | DROP CORD           | 50      |      |        |       | ı      |        | 3500             | 2300  |         | 30     |       | CORD |                   | G    |
| G        | -                   | 2       |      | 3500   | 2300  |        |        | 1                |       |         | 2      |       |      |                   | G    |
| G        | DROP CORD           | 30      |      |        |       | 2300   | 3500   | 0700             | 7500  |         | 50     |       | CORD |                   | G    |
| G<br>G   | -<br>IN-FLOOR VAULT | 100     |      | 7500   | 0     | 1      |        | 2300             | 3500  |         | 2      | -     |      |                   | G    |
| <u> </u> |                     | 2       |      | 7500   | 0     | 7500   | 0      | 1                |       |         |        |       |      |                   |      |
| G        | DROP CORD RECP      | 20      |      |        |       | /500   |        | 1000             | 1000  |         | 20     | DROP  | CORD | RECP              | G    |
|          |                     |         |      | 0      | 0     | ]      |        |                  |       |         |        |       |      |                   |      |
| G        | DROP CORD RECP      | 20      |      |        |       | 1000   | 0      | ]                |       |         |        |       |      |                   |      |
| G        | DROP CORD RECP      | 20      |      |        |       |        |        | 1000             | 1000  |         | 20     | DROP  | CORD | RECP              | G    |
|          |                     |         |      | 0      | 0     |        |        |                  |       |         |        |       |      |                   |      |
| G        | DROP CORD RECP      | 20      |      |        |       | 1000   | 0      |                  |       |         |        |       |      |                   |      |
| G        | DROP CORD RECP      | 20      |      |        |       |        |        | 1000             | 1000  |         | 20     | DROP  | CORD | RECP              | G    |
|          |                     |         |      | 0      | 0     |        |        | 1                |       |         |        |       |      |                   |      |
| G        | DROP CORD RECP      | 20      |      |        |       | 1000   | 0      |                  |       |         |        |       |      |                   |      |
| G        | DROP CORD RECP      | 20      |      |        | -     | 1      |        | 1000             | 0     |         |        |       |      |                   |      |
|          |                     |         |      | 0      | 0     |        |        | 1                |       |         |        |       |      |                   |      |
| G        |                     |         |      |        |       | 0      | 0      | 1000             |       |         |        |       |      |                   |      |
| 6        | DROP CORD RECP      | 20      |      | 20300  |       | 23300  |        | 19600            | 0     |         |        |       |      |                   |      |
|          | LOAD TYPE           |         | CON  | INECTE | d kva | TO1    | TAL    | FAC <sup>®</sup> | TOR   | )<br>DE | EMAND  | KVA   |      | TOTAL             |      |
|          |                     |         | A    | в      | С     | ALL P  | PHASES |                  |       | A       | В      | С     | 4    | ALL PHASES        |      |
|          | LIGHTING            |         | 0.0  | 0.0    | 0.0   | 0.0    |        | 125%             |       | 0.0     | 0.0    | 0.0   |      | 0.0               |      |
|          | RECEPTACLE (10KVA O | r less) | 0.0  | 0.0    | 0.0   | 0.0    |        | 100%             |       | 0.0     | 0.0    | 0.0   |      | 0.0               |      |
|          | RECEPTACLE (OVER 10 | KVA)    | 0.0  | 0.0    | 0.0   | 0.0    |        | 50%              |       | 0.0     | 0.0    | 0.0   |      | 0.0               |      |
|          | HVAC/MOTOR          |         | 0.0  | 0.0    | 0.0   | 0.0    |        | 100%             |       | 0.0     | 0.0    | 0.0   |      | 0.0               |      |
|          | MOTOR(LARGEST)      |         | 0.0  | 0.0    | 0.0   | 0.0    |        | 125%             |       | 0.0     | 0.0    | 0.0   |      | 0.0               |      |
|          | KITCHEN EQUIPMENT   |         | 0.0  | 0.0    | 0.0   | 0.0    |        | 100%             |       | 0.0     | 0.0    | 0.0   |      | 0.0               |      |
|          | MISCELLANEOUS       |         | 20.3 | 23.3   | 19.6  | 63.2   |        | 100%             |       | 20.3    | 23.3   | 19.6  |      | 63.2              |      |
|          | тот                 | ral kva | 20.3 | 23.3   | 19.6  | 63.2   |        | TOTA             | L KVA | 20.3    | 23.3   | 19.6  |      | 63.2              | 4    |
|          | WITH GROUND BUS     |         |      |        |       |        |        | TOTAL            | AMPS  | 169.2   | 194.2  | 163.3 |      | 175. <del>4</del> |      |



GENERAL NOTES: A. NEW AND RELOCATED ITEMS SHOWN AS BOLD \_\_\_\_\_\_ EXISTING ITEMS SHOWN AS LIGHT \_\_\_\_\_



- 1. PROVIDE NEW UNDERGROUND FEEDER TO THE LARGE VEHICLE STORAGE BUILDING. REFER TO THE TYPICAL TRENCH DETAIL, THIS SHEET, FOR ADDITIONAL INFORMATION. MINIMUM BURIAL DEPTH SHALL BE 24" FROM FINISHED GRADE TO TOP OF CONDUIT, WITH WARNING TAPE INSTALLED IN TRENCH AT 8" BELOW FINISH GRADE. 2. TRANSITION FROM NON-METALLIC CONDUIT TO GRC AT BUILDING STUB-UP. LOCATION OF CONDUIT STUB-UP IS APPROXIMATE.
- 3. PROVIDE NON-FUSED DISCONNECT AT BUILDING EXTERIOR FOR LOCAL DISCONNECTING MEANS, PER ONE-LINE. EXACT LOCATION TO BE COORDINATE IN FIELD.
- 4. PROVIDE 4" SPARE SCHEDULE 40 PVC CONDUIT WITH PULL STRING IN THE SAME TRENCH AS THE ELECTRICAL FEEDERS. COORDINATE EXACT STUB-UP LOCATIONS IN FIELD. AT THE TRAFFIC OPERATIONS BUILDING, STUB INTO THE MAIN ELECTRICAL ROOM. CAP CONDUIT ENDS WITH WEATHER-PROOF CAPS AND LABEL CONDUIT AS SPARE. 5. PROVIDE PERMANENT LABEL ON THE NONFUSED DISCONNECT CLEARLY INDICATING THAT IT IS A SERVICE DISCONNECTING MEANS FOR THE BUILDING.
- EXISTING POLE LIGHT TO BE RELOCATED. SEE ARCHITECTURAL PLANS FOR NEW LOCATION. PROVIDE NEW POLE BASE AS SHOWN IN THE POLE BASE DETAIL, THIS SHEET. INTERCEPT AND EXTEND EXISTING BRANCH CIRCUIT AND UPSIZE CONDUCTORS ONE STANDARD CONDUCTOR SIZE FOR EVERY ADDITIONAL 75'-0" OF BRANCH CIRCUIT LENGTH.

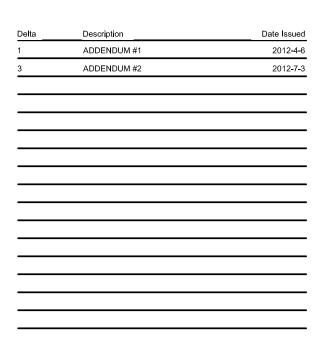


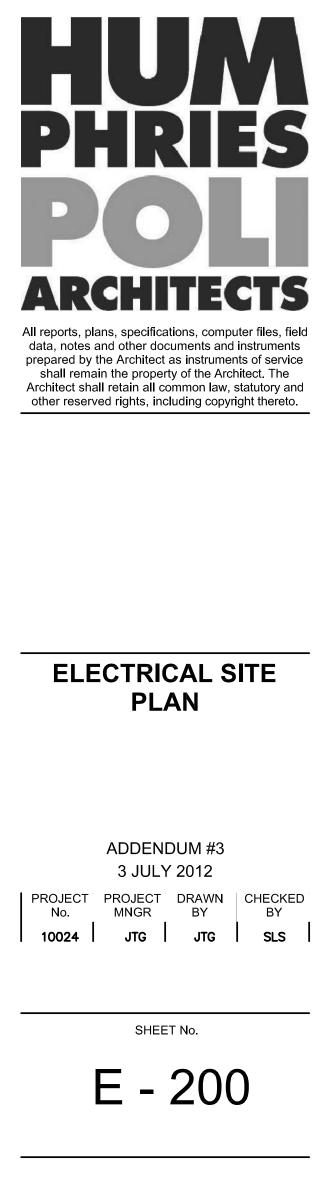
1 E-200 NO SCALE

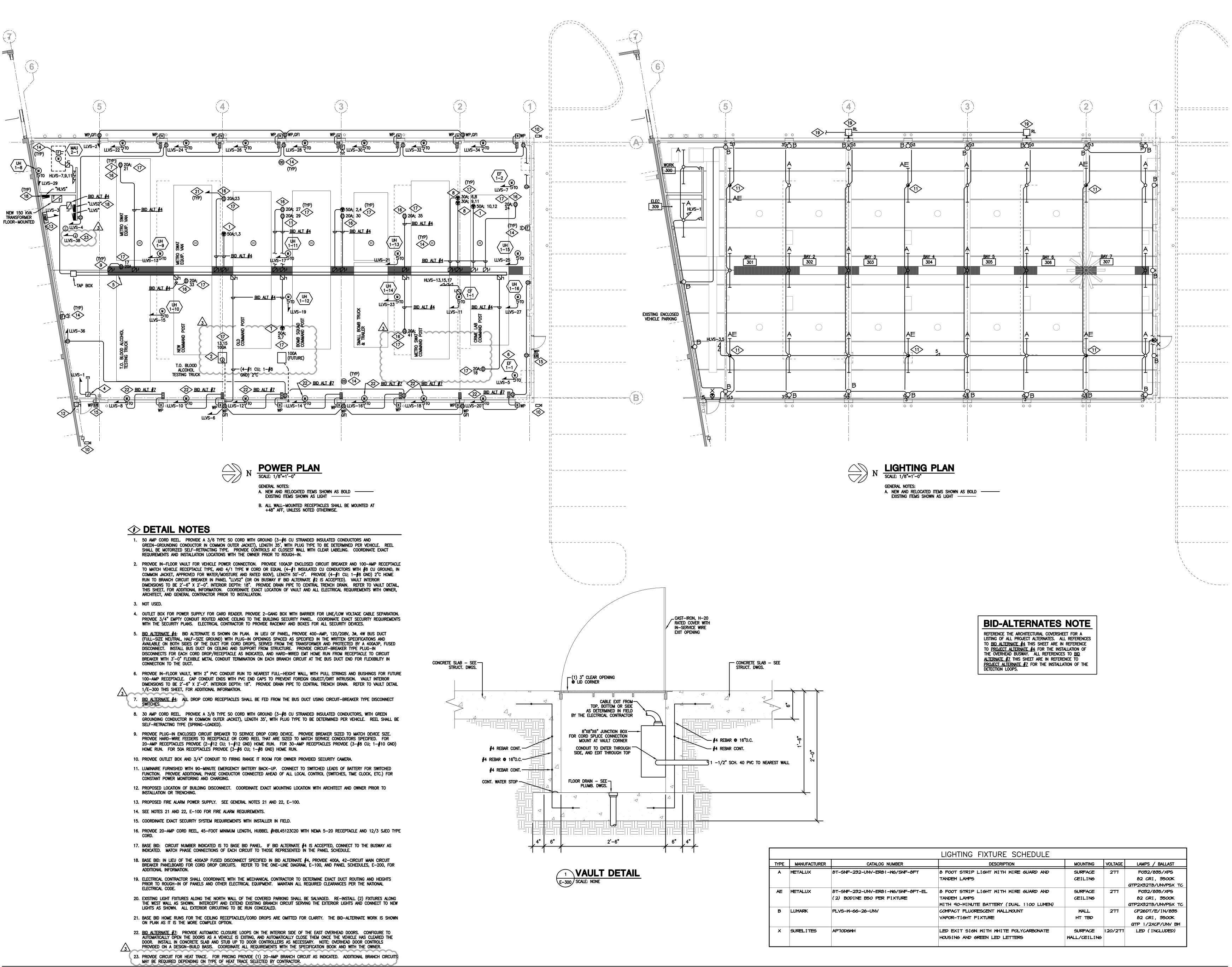
|              |                       |      | -  |     | M   |     | NICAL EQUIPMENT SC  | HEDULE  | -    |      |                |         |
|--------------|-----------------------|------|----|-----|-----|-----|---------------------|---------|------|------|----------------|---------|
| DESIGNATION  | DESCRIPTION           | VOLT | РН | FLA | HP  | KVA | CONDUCTORS          | CONDUIT | sw   | СВ   | FUSE SIZE/TYPE | REMARKS |
|              |                       |      |    |     |     |     |                     |         |      |      |                |         |
| -2–1         | MAKEUP AIR UNIT (GAS) | 480  | 3  | _   | 3   | -   | 3-#12 CU; 1-#12 GND | 3/4"    | 30/3 | 15/3 | 15A FRS-R      | Α       |
| -1           | EXHAUST FAN           | 120  | 1  | -   | 1/2 | -   | 2-#12 CU; 1-#12 GND | 1/2"    | STO  | 20/1 | -              | A,B     |
| -2           | EXHAUST FAN           | 120  | 1  | -   | 1/2 | -   | 2-#12 CU; 1-#12 GND | 1/2"    | STO  | 20/1 | -              | A,B     |
| -1           | CEILING FAN           | 480  | 3  | _   | 1.5 | -   | 3-#12 CU; 1-#12 GND | 1/2"    | 30/3 | 15/3 | 10A FRS-R      | Α       |
| -1           | INFRARED HTR (GAS)    | 120  | 1  | 5   | -   | -   | 2-#12 CU; 1-#12 GND | 1/2*    | STO  | 20/1 | -              | Α       |
| -2 THRU 1-6  | INFRARED HTR (GAS     | 120  | 1  | 1   | -   | -   | 2-#12 CU; 1-#12 GND | 1/2"    | STO  | 20/1 | -              | Α       |
| -1 THRU 1-7  | UNIT HEATER (GAS)     | 120  | 1  | -   | _   | 0.3 | 2-#12 CU; 1-#12 GND | 1/2"    | STO  | 20/1 | -              | A       |
| -8 THRU 1-16 | UNIT HEATER (GAS)     | 120  | 1  | 5.3 | 1/3 | -   | 2-#12 CU; 1-#12 GND | 1/2*    | STO  |      | -              | A       |
|              |                       |      |    |     |     |     |                     |         |      |      |                |         |

A. REFER TO THE MECHANICAL PLANS FOR ALL CONTROL REQUIREMENTS. ANY LINE-VOLTAGE CONTROL ELEMENTS TO BE INSTALLED AND WIRED BY ELECTRICAL. B. INTERLOCK UNIT WITH CARBON MONOXIDE SENSORS. REFER TO MECHANICAL DRAWINGS FOR SENSOR LOCATIONS.





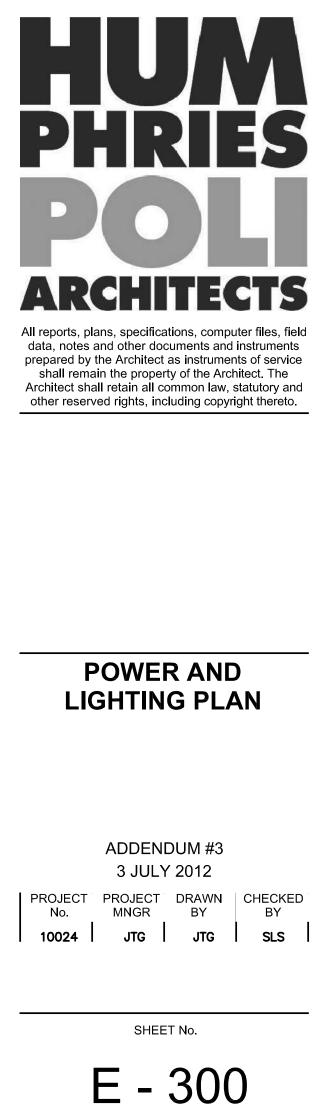


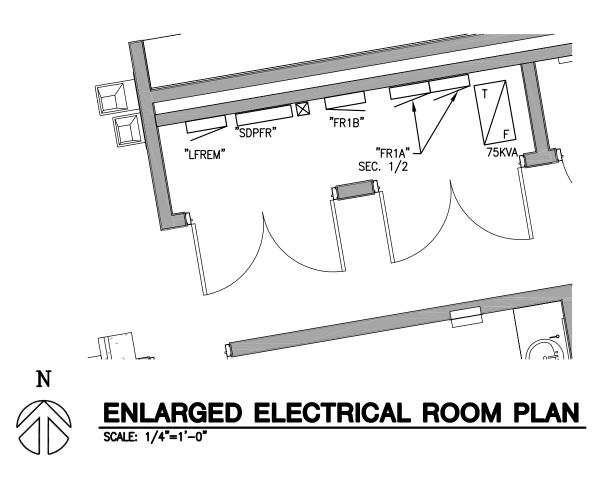


|          |                                   | LIGHTING FIXTURE SCHEDULE                |              | _       |                                      |
|----------|-----------------------------------|------------------------------------------|--------------|---------|--------------------------------------|
| FACTURER | CATALOG NUMBER                    | DESCRIPTION                              | MOUNTING     | VOLTAGE | LAMPS / BALLAST                      |
| X        | 8T-SNF-232-UNV-ER81-WG/SNF-8FT    | 8 FOOT STRIP LIGHT WITH WIRE GUARD AND   | SURFACE      | 277     | F032/835/XPS                         |
|          |                                   | TANDEM LAMPS                             | CEILING      |         | 82 CRI, 3500K<br>QTP2X32T8/UNVPSX TC |
| JX       | 8T-SNF-232-UNV-ER81-WS/SNF-8FT-EL | 8 FOOT STRIP LIGHT WITH WIRE GUARD AND   | SURFACE      | 277     | F032/835/XPS                         |
|          | (2) BODINE B50 PER FIXTURE        | TANDEM LAMPS                             | CEILING      |         | 82 CRI, 3500K                        |
|          |                                   | WITH 90-MINUTE BATTERY (DUAL 1100 LUMEN) |              |         | QTP2X32T8/UNVPSX TC                  |
| <        | PLVS-W-66-26-UNV                  | COMPACT FLUORESCENT WALLMOUNT            | WALL         | 277     | CF26DT/E/IN/835                      |
|          |                                   | VAPOR-TIGHT FIXTURE                      | HT TBD       |         | 82 CRI, 3500K                        |
|          |                                   |                                          |              |         | QTP 1/2XCF/UNV BM                    |
| ITES     | APTODGWH                          | LED EXIT SIGN WITH WHITE POLYCARBONATE   | SURFACE      | 120/277 | LED (INCLUDED)                       |
|          |                                   | HOUSING AND GREEN LED LETTERS            | WALL/CEILING |         |                                      |



| Delta | Description | Date Issued |
|-------|-------------|-------------|
| 1     | ADDENDUM #1 | 2012-4-6    |
| 3     | ADDENDUM #2 | 2012-7-3    |
|       |             |             |
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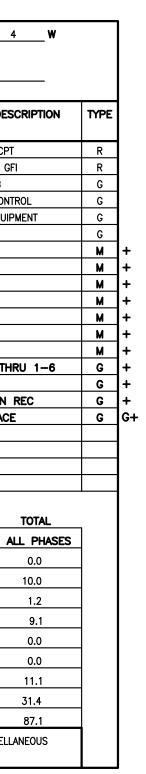


|      | PANEL "FR1B" (EXISTIN |        |      | -      | v    |         | 120     | . /    | 208    | <b>v</b> | 3      | ø .    | 4          |
|------|-----------------------|--------|------|--------|------|---------|---------|--------|--------|----------|--------|--------|------------|
|      | FLUSH                 | MAIN   |      | -      |      |         | Χ       | •      |        |          |        |        |            |
|      |                       | BUS    | 100A | -      | FEEC | D THRU  |         |        | -      | A.I.C.   | 10,000 |        |            |
| TYPE | DESCRIPTION           | BKR    | CIR  |        | LOAD | (VOLT A | MPS)    | / PHAS | E      | CIR      | BKR    |        | DESCR      |
|      |                       |        |      | A      |      | В       |         | С      |        |          |        |        |            |
| G    | CHARGER               | 20     | 1    | 650    | 1080 |         |         |        |        | 2        | 20     | GARAGE | RCPT       |
| G    | CHARGER               | 20     | 3    |        |      | 650     | 540     |        |        | 4        | 20     | ROOF 1 | TOP GFI    |
| G    | CHARGER               | 20     | 5    |        |      | -       |         | 650    | 250    | 6        | 20     | AUDIO  | CAB        |
| G    | CHARGER               | 20     | 7    | 650    | 500  |         |         |        |        | 8        | 20     | 4      | CONTRO     |
| R    | POWER POLE            | 20     | 9    |        |      | 900     | 2000    |        | 1      | 10       | 50     |        | EQUIPME    |
| R    | POWER POLE            | 20     | 11   |        |      | -       |         | 540    | 2000   | 12       | 2      | -      |            |
| R    | POWER POLE            | 20     | 13   | 540    | 1176 |         |         | 1      |        | 14       | 20     | UH-1   |            |
| R    | POWER POLE            | 20     | 15   |        |      | 540     | 1176    |        |        | 16       | 20     | UH-1   |            |
| R    | POWER POLE            | 20     | 17   |        |      | 1       |         | 900    | 1176   | 18       | 20     |        |            |
| R    | POWER POLE            | 20     | 19   | 540    | 1176 |         |         | 1      |        | 20       | 20     | UH-1   |            |
| R    | POWER POLE            | 20     | 21   |        |      | 540     | 1176    |        | 1      | 22       | 20     | UH-1   | -5         |
| R    | POWER POLE            | 20     | 23   |        |      | ٦       |         | 540    | 1176   | 24       | 20     | UH-1   |            |
| R    | HAIR DRYER            | 30     | 25   | 1700   | 1176 |         |         | 1      |        | 26       | 20     |        |            |
| R    | HAIR DRYER            | 30     | 27   |        |      | 1700    | 600     |        |        | 28       | 20     |        | -2 THRU    |
| R    | HAIR DRYER            | 30     | 29   |        |      | 1       |         | 1700   | 600    | 30       | 20     | IR-1-  |            |
| G    | TARGET REEL           | 15     | 31   | 500    | 500  | 500     |         | 1      |        | 32       | 20     |        | STN RE     |
| G    | TARGET REEL           | 15     | 33   |        |      | 500     | 500     | 500    |        | 34       | 20     |        | TRACE      |
| G    | TARGET REEL           | 15     | 35   | 700    |      | 1       |         | 500    | 0      | 36       |        | SPACE  |            |
| R    | GARAGE RECPS          | 20     | 37   | 360    | 0    | 700     | •       | 1      |        | 38       |        | SPACE  |            |
| R    | GARAGE RECPS          | 20     | 39   |        |      | 360     | 0       |        |        | 40       |        | SPACE  |            |
| M    | OVERHEAD DR           | 20     | 41   | 40540  |      | 44400   |         | 864    | 0      | 42       |        | SPACE  |            |
|      |                       |        |      | 10548  |      | 11182   |         | 10896  |        | ]        |        |        | _          |
|      | LOAD TYPE             |        | CON  | INECTE |      | 1       | TAL     | FAC    | TOR    |          | EMAND  |        | T          |
|      |                       |        | A    | В      | C    |         | PHASES  |        |        | A        | B      | C      | ALL        |
|      | LIGHTING              |        | 0.0  | 0.0    | 0.0  | 0.0     |         | 125%   |        | 0.0      | 0.0    | 0.0    |            |
|      | RECEPTACLE (10KVA OR  | LESS)  | 3.3  | 3.3    | 3.3  | 10.0    |         | 100%   |        | 3.3      | 3.3    | 3.3    | 1          |
|      | RECEPTACLE (OVER 10   | (VA)   | 0.9  | 1.3    | 0.4  | 2.5     |         | 50%    |        | 0.4      | 0.6    | 0.2    |            |
|      | HVAC/MOTOR            |        | 3.5  | 2.4    | 3.2  | 9.1     |         | 100%   |        | 3.5      | 2.4    | 3.2    |            |
|      | MOTOR(LARGEST)        |        | 0.0  | 0.0    | 0.0  | 0.0     |         | 125%   |        | 0.0      | 0.0    | 0.0    |            |
|      | KITCHEN EQUIPMENT     |        | 0.0  | 0.0    | 0.0  | 0.0     |         | 100%   |        | 0.0      | 0.0    | 0.0    |            |
|      | MISCELLANEOUS         |        | 2.8  | 4.3    | 4.0  | 11.1    |         | 100%   |        | 2.8      | 4.3    | 4.0    | 1          |
|      | TOT                   | AL KVA |      | 11.2   | 10.9 | 32.6    |         | тот/   | AL KVA | 10.1     | 10.6   | 10.7   | 3          |
|      | WITH GROUND BUS       |        |      | •      |      |         |         |        | . AMPS |          | 88.0   | 89.3   | 8          |
|      | LEGEND L = LIG        | ITING  | R =  | RECEPT | ACLE | M = H   | -IVAC / |        |        | = Kitci  |        |        | IISCELLANE |

+ PROVIDE NEW CIRCUIT BREAKER TO MATCH EXISTING MANUFACTURER AND AIC RATING.

G PROVIDE GFI BREAKER.







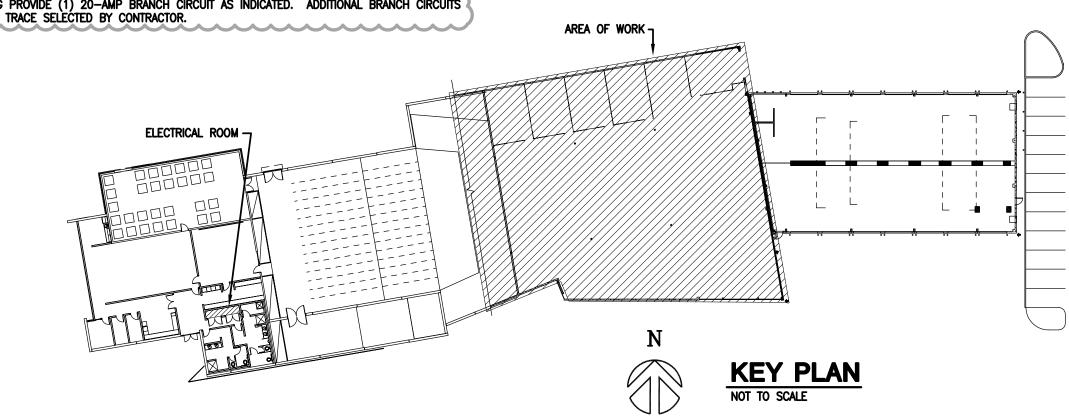
# **OETAIL NOTES**

- INSIDE THE GARAGE AREA. 7. SWITCH TO BE RELOCATED. SEE NOTE 8, THIS SHEET.
- PRIOR TO INSTALLATION.

# **COVERED PARKING ELECTRICAL PLAN** SCALE: 1/8"=1'-0"

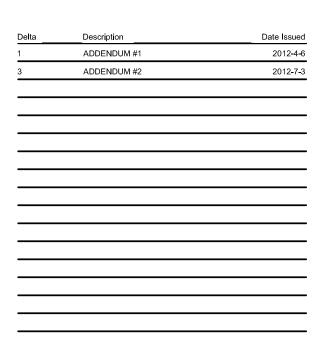
A. NEW AND RELOCATED ITEMS SHOWN AS BOLD \_\_\_\_\_ EXISTING ITEMS SHOWN AS LIGHT \_\_\_\_\_

- 1. EXISTING POWER, LIGHTING, SECURITY, FIRE ALARM, ETC. DEVICES ARE NOT SHOWN. ALL EXISTING DEVICES TO REMAIN. 2. PROVIDE TYPE-WRITTEN PRINTED LABELS ON EACH DEVICE INDICATING SERVING BRANCH CIRCUIT. ALL DEVICES TO BE INSTALLED IN INDUSTRIAL-STYLE STAMPED STEEL SURFACE-MOUNTED OUTLET BOXES TO MATCH APPEARANCE OF EXISTING DEVICES, AND TO BE GFI, UL-LISTED WARTHER-RESISTANT TYPE RECEPTACLE, COLOR GRAY TO MATCH EXISTING. WEATHERPROOF COVERPLATES ARE NOT REQUIRED
- 3. COORDINATE ROUTING OF NEW HOME RUN CONDUITS THROUGH THE FIRING RANGE WITH OWNER. HOME RUNS FOR THE NEW 120V CIRCUITS IN THE VICINITY OF THE NORTH WALL TO BE (2-#6 CU; 1-#6 GND) 1"C TO ACCOUNT FOR VOLTAGE DROP. PROVIDE "PIG TAIL" CONNECTORS AT RECEPTACLES SIZED AS NEEDED TO CONNECT THE LARGER WIRE TO THE SMALLER LUGS. 4. UPSIZE HOME RUN TO THIS EQUIPMENT TO (2-#8 CU; 1-#8 GND). VERIFY EXACT SIZING REQUIREMENTS WITH ACTUAL CIRCUIT LENGTH IN THE FIELD. MAXIMUM VOLTAGE DROP SHALL NOT EXCEED 5% FOR THE ENTIRE CIRCUIT (INCLUDING PANEL FEEDERS). 5. UPSIZE HOME RUN TO THIS EQUIPMENT TO (2-#10 CU; 1-#10 GND). VERIFY EXACT SIZING REQUIREMENTS WITH ACTUAL CIRCUIT LENGTH IN THE FIELD. MAXIMUM VOLTAGE DROP SHALL NOT EXCEED 5% FOR THE ENTIRE CIRCUIT (INCLUDING PANEL FEEDERS).
- 6. EXISTING FIXTURE TO BE RELOCATED. REMOVE FIXTURE AND PROTECT DURING DEMOLITION. PROTECT EXISTING CIRCUIT FOR INTERCEPTION AND EXTENSION TO NEW FIXTURE LOCATIONS. SEE LIGHTING PLAN, E-300 DETAIL NOTE 19. 8. CONNECT RELOCATED 3-WAY SWITCH TO EXISTING SWITCH LEG. INTERCEPT AND EXTEND CIRCUIT TO NEW LOCATION.
- 9. OVERHEAD DOOR OPERATOR. MATCH EXISTING OPERATORS IN THIS GARAGE. PROVIDE 120V, 10, 20A CONNECTION TO OPERATOR.
- PROVIDE PUSH-BUTTON OPERATION AND COORDINATE SECURITY SYSTEM INTERFACE REQUIREMENTS WITH OWNER'S SECURITY VENDOR
- 10. PROVIDE RECEPTACLE FOR WASH STATION. COORDINATE EXACT LOCATION WITH OWNER PRIOR TO ROUGH-IN.
- 11. UPSIZE ALL WIRING THROUGHOUT THIS CIRCUIT AS NOTED. 12. PROVIDE CIRCUIT FOR HEAT TRACE. FOR PRICING PROVIDE (1) 20-AMP BRANCH CIRCUIT AS INDICATED. ADDITIONAL BRANCH CIRCUITS MAY BE REQUIRED DEPENDING ON TYPE OF HEAT TRACE SELECTED BY CONTRACTOR.





Denver Traffic **Operations Command** Vehicle Storage & Modifications 3501 Park Avenue Denver, CO 80216





#### CITY AND COUNTY OF DENVER DEPARTMENT OF PUBLIC WORKS Engineering Division

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#### CITY AND COUNTY OF DENVER DEPARTMENT OF PUBLIC WORKS Engineering Division

#### NOTICE FOR INVITATION FOR BIDS CONTRACT NO. 201206436

#### DENVER POLICE DEPARTMENT COMMAND VEHICLE GARAGE

#### BID SCHEDULE: 11:00 AM, Local Time JULY 12, 2012

Sealed bids will be received at the Office of Economic Development (OED) Reception Desk located on the 2<sup>nd</sup> floor at 201 West Colfax, Denver, CO 80202, beginning at 10:30 a.m., no later than 11:00 a.m., on bid day.

Bids submitted prior to 10:30 a.m. on the specified bid opening date/time shall be presented at the Office of Contract Administration, Attention: Public Works Contract Administration, 201 West Colfax Avenue, Department 614, Denver, Colorado 80202. All properly delivered bids will then be publicly opened and read aloud in Room 1.D.1 on the 1st floor at 201 West Colfax, Denver, Colorado 80202.

Prior to submitting a bid, the bidder shall consult the Contractor's Bulletin Board located at 201 W. Colfax, 2<sup>nd</sup> Floor, Denver, Colorado, 80202 and/or <u>www.work4denver.com</u>.

#### **GENERAL STATEMENT OF WORK:**

The Command Vehicle Garage project is an addition to the existing DPD firing range and will be used for the storage of large DPD command vehicles. The work consists of existing asphalt removal, over excavation and recompaction of subgrade, an insulated structural steel frame, corrugated metal wall skin with insulated sectional garage doors, TPO roof, gas fired unit heaters, lighting and exhaust fans, sand/oil interceptor, spread footings with slab on grade.

#### **ESTIMATED CONSTRUCTION COST:**

The estimated cost of construction for this project is between \$954,900.00 and \$1,167,100.00.

#### DOCUMENTS AND BID INFORMATION AVAILABLE:

Contract Documents complete with Technical Specifications and, if applicable, construction drawings will be available on the first day of publication at: <u>www.work4denver.com</u>. To download digital Contract Documents at a cost of \$10.00 per download, reference eBid Document Number **#2096932**. Contact QuestCDN.com at 952-233-1632 or <u>info@questcdn.com</u> for assistance.

#### **PRE-BID CONFERENCE:**

A pre-bid conference will be held for this Project at 11:00 AM, local time, on JUNE 14, 2012. This meeting will take place at: 201 W. Colfax Ave., Denver, CO. 80202, Conference Room 4.F.6 located on the 4<sup>th</sup> floor. A prearranged building site inspection will be available to interested parties on June 18, 2012 at 11:00 A.M. Site location: 3381 Park Avenue West, Denver, CO. 80216. Details will be provided at the Pre-Bid conference.

DEADLINE TO SUBMIT QUESTIONS: June 26, 2012 by or before 5:00 p.m., local time.

#### **PREQUALIFICATION REQUIREMENTS:**

Each bidder must be prequalified in <u>7a GENERAL</u> in the <u>\$1,500,00.00</u> monetary level in accordance with the City's Rules and Regulations Governing Prequalification of Contractors. Each bidder must have submitted a prequalification application a minimum of ten (10) calendar days prior to the bid opening date. Applications must be submitted to the Department of Public Works, Prequalification Section, 201 West Colfax Avenue, Department 506, Denver, Colorado 80202. To view the Rules and Regulations and to obtain a prequalification application, please visit our website at <u>www.denvergov.org/prequalification</u> or call 720-913- for prequalification information ONLY.

Contract No. 201206436 DPD CVG

#### MINORITY AND WOMAN BUSINESS ENTERPRISE PARTICIPATION:

Construction, reconstruction and remodeling contracts made and entered into by the City and County of Denver are subject to Article III, Divisions 1 and 3 of Chapter 28 of the Denver Revised Municipal Code, (Sections 28-31 to 29-36 and 28-52 to 28-90 D.R.M.C) and all Minority and Woman Business Enterprise and Equal Employment Opportunity Rules and Regulations adopted by the Director of the Division of Small Business Opportunity.

Article III, Division 3 of Chapter 28 of the D.R.M.C. directs the Director of the Division of Small Business Opportunity to establish a project goal for expenditures on construction, reconstruction, and remodeling work contracted by the City and County of Denver. The specific goal for this project is:

#### 25.00% Minority and Woman Business Enterprise (M/WBE) Participation

Project goals must be met with certified participants as set forth in Section 28-60, D.R.M.C. or through the demonstration of a sufficient good faith effort under Section 28-62 D.R.M.C. For compliance with good faith requirements under Section 28-62(b), the M/WBE percentage solicitation level required for this project is 100%.

The Director of the Division of Small Business Opportunity urges all participants in City construction, reconstruction and remodeling projects to assist in achieving these goals.

#### MISCELLANEOUS:

Contracts for construction, reconstruction, and remodeling are subject to the City prevailing wage rate requirements established pursuant to Section 20-76, D.R.M.C.

As its best interest may appear, the City and County of Denver reserves the right to reject any or all bids and to waive informalities in bids.

If applicable, a shortened version of this Notice of Invitation for Bids and the Statement of Quantities can be viewed on the City and County of Denver website at:

http://www.denvergov.org/SearchBidAdvertisements/tabid/385460/Default.aspx.

Publication Dates: June 6, 7, 8, 2012

Published In: The Daily Journal

#### CITY AND COUNTY OF DENVER DEPARTMENT OF PUBLIC WORKS Engineering Division

#### **INSTRUCTIONS TO BIDDERS**

#### **IB-1 INSTRUCTION TO BIDDERS**

These Instructions to Bidders are a part of the Contract Documents and are intended to serve as a guide to bidders. They are general in nature and may be amended or supplemented as needed to support any one specific invitation to bid. Each bidder shall prepare its bid in strict compliance with all requirements of the Contract Documents and by careful application of these instructions.

#### **IB-2 BIDDING**

The copy of the Contract Documents contains the Bid Form and Submittal Package for this Project, which must be used to submit a bid hereunder. The bidder must fully complete, execute and submit this Bid Form and Submittal Package, along with any other specified components of the Contract Documents, as its bid for the referenced Project.

A bidder is not required to submit as part of its bid the entire set of Contract Documents distributed by the City pursuant to the Notice of Invitation for Bids, if the bidder executes and submits the Bidder Acknowledgment Form included with the Bid Form and Submittal Package as part of its bid. However, each bidder, by submitting its bid, shall be conclusively presumed to have received and reviewed all of the information contained in the Contract Documents as this term is further defined herein.

Each bid must be enclosed in a sealed envelope, must be addressed to the Manager and must show on the face of the envelope the full name of the bidder, the City Project number, and descriptive title of the Project for which the bid is made.

The advertisement for Notice of Invitation for Bids will identify where and when the bid must be delivered.

#### **IB-3 CONTRACT DOCUMENTS AS PUBLISHED BY CITY**

Each bidder shall be responsible for, and shall be deemed to have received, all the information contained in the Contract Documents as distributed by the City pursuant to the Notice of Invitation for Bids, including addenda, whether or not such bidder has reviewed all or part of the Contract Documents in either its hard copy form or in any other format. If organizations or companies other than the City or its design professional distribute the City's Contract Documents for review by prospective bidders, whether in hard copy or via electronic or other media, neither the City nor its design professional shall be responsible for the content, completeness or accuracy of any information distributed or transmitted by any such organization or company.

#### **IB-4 COMPLETING AND SIGNING THE BID FORMS**

The bidder must complete the Bid Form by legibly writing or printing in ink, in words and figures as required, all the bidder's prices offered for the Work to be performed. All blank spaces, which require a response of the bidder, must be properly completed in full. If in the process of evaluating a bid, words and figures, as written on the Bid Form by the bidder, do not agree, the written words will govern.

For Bid Forms requiring unit price bids, the bidder shall write in the Bid Form spaces provided a unit price for each item for which a quantity is given and shall also write the product of each unit price and the quantity specified in the "Amount" or "Total" space provided.

Each bidder must sign the Bid Form and give the bidder's current business address. If an individual, the signature must be of the individual offering the bid; if a partnership, the signature must be that of a general partner; and if a corporation, both the president and the secretary must sign and the seal of the corporation must be affixed. Signatures of other persons may be acceptable if the bid contains sufficient evidence, satisfactory to the City in its sole discretion, to indicate that the other persons are authorized to bind the bidder.

#### **IB-5** UNACCEPTABLE BIDS

The City will not accept bids from Bidders not prequalified with the Department of Public Works (if prequalification is required for this project), in arrears to the City upon debt or contract, or which are defaulters (as surety or otherwise) upon any obligation to the City.

#### **IB-6 INFORMAL AND UNBALANCED BIDS**

Any alteration, interlineations, erasure, omission, deletion or addition by the bidder to the Bid Form and Submittal Package or other parts of the Contract Documents submitted with the Bid Form and Submittal Package, as originally issued to the bidder, shall render the accompanying bid informal and may constitute cause for rejection.

Any unauthorized addition, conditional or alternate bids, failure to provide a unit price, lump sum amount or authorized alternate item specified or other irregularities of any kind which tend to render the bid incomplete, indefinite or ambiguous shall render the bid informal and may constitute cause for rejection.

Bids that are unbalanced so that each item does not reasonably carry its own proportion of cost or that contain inadequate or unreasonable prices for any item may be rejected. Bids, which have not acknowledged all addenda to the Contract Documents issued for this bid, may also be rejected.

The right is reserved by the City to reject any or all bids and to waive any informalities where it is deemed by the City to be in the best interests of the City to do so.

#### **IB-7** ONLY ONE BID ACCEPTED

The City will accept only one bid for the same work from any one bidder. This includes bids that may be submitted under different names by one business enterprise.

#### **IB-8 BID GUARANTEE**

As a guarantee of good faith on the part of the bidder, each bid must be accompanied by a bid guarantee, consisting of either a certified or cashier's check made payable without condition to the order of the City and County of Denver or a bid bond written by an approved corporate surety in favor of the City and County of Denver. If the bid of a bidder is acceptable and the bidder is notified by the Manager that it is considered to be the Apparent Low Bidder and said bidder fails to execute a contract in the form prescribed or to furnish a performance and payment bond with a legally responsible and approved surety or to furnish the required evidence of insurance or satisfy all conditions precedent to contract execution within five (5) days after such notice is made by the City, said bid guarantee shall be forfeited to the City as liquidated damages and not as a penalty.

The bid guarantee shall be in the amount of five percent (5%) of the total bid unless otherwise specified in the Notice of Invitation for Bids and on the form appearing in the Contract Documents in the Bid Form and Submittal Package. Failure to submit a proper bid guarantee, satisfying all of the requirements specified herein and on the form provided herein shall render the bid nonresponsive and may constitute cause for rejection.

Following award and execution of the Contract by the Apparent Low Bidder, or earlier in the sole discretion of the City, bid guarantees of all but the Apparent Low Bidder will be returned. When the Apparent Low Bidder executes the Contract and delivers to the City satisfactory performance and payment bonds, required insurance documentation, and has satisfied all conditions precedent to contract execution by the City, and after approval, if any, by the Council of the City of the proposed Contract with the Apparent Low Bidder, the bid guarantee of the Apparent Low Bidder shall be returned. Such return shall be made within one hundred twenty (120) days from date bids are opened unless otherwise specified in the Special Contract Conditions.

#### **IB-9** SITE INSPECTION AND INVESTIGATIONS

Prior to submitting a bid, the bidder is invited to inspect the work site and its surroundings. Although the bidder is not required to make such an inspection before bidding, for purposes of the Contract it shall be conclusively presumed that by failing to make such an inspection, the bidder has waived the right to later

claim additional compensation or time extensions for conditions which would have been evident had the site been inspected.

Drawings and Technical Specifications, defining the Work to be done, were prepared on the basis of interpretation by the design professionals of information derived from investigations of the work site. Such information and data are subject to sampling errors, and the interpretation of the information and data depends to a degree on the judgment of the design professional. In view of this, the bidder is invited to make such additional investigations as the bidder's judgment dictates the need for such investigations. Information about the degree of difficulty of the Work to be done cannot totally be derived from either the Drawings or Technical Specifications or from the Manager or his representatives.

Since the bid information cannot be guaranteed, the Contractor shall have assumed the risks attendant to successful performance of the Work and shall never make claim for additional compensation or time extensions on the grounds that the nature or amount of work to be done was not understood by the bidder at the time of the bidding.

#### **IB-10 INCONSISTENCIES**

Any seeming inconsistencies or ambiguities between different provisions of the Contract Documents or any point which the bidder believes requires a decision or interpretation by the City must be inquired into by the bidder by addressing a formal written communication to the Manager of Public Works and sending or delivering it to the offices of the Division of Public Works advertising this Project for bid at least fortyeight (48) hours, excluding Saturdays, Sundays, and holidays, before the time set for the opening of bids

Information about the decision or interpretation made in response to any inquiry will be posted on the Contractor's Bulletin Board (refer to IB-12 CONTRACTOR'S BULLETIN BOARD, for the location of the Contractor's Bulletin Board). If the matter raised requires, in the sole discretion of the Manager, that an addendum to the bid documents be issued, such addendum will be published and each bidder shall be required to acknowledge the addendum by signing and identifying it in the Bid Form when submitting the bid.

After bids are opened, all bidders must abide by the formal response of the Manager, as to any interpretation. The City shall not be bound and the bidder shall not rely on any oral communication, interpretation clarification or determination of the Contract Documents prior to bid opening.

#### **IB-11 WITHDRAWAL OF BID**

A bidder may withdraw its bid at any time prior to the time for receipt of bids set forth in the Notice of Invitation for Bids by making written request upon the Manager of Public Works. After such time, no bid may be withdrawn or modified.

Such request must be signed by the persons authorized to bind the bidder as defined in IB-3, COMPLETING AND SIGNING BID FORMS.

#### **IB-12 CONTRACTOR'S BULLETIN BOARD**

It shall be conclusively presumed that the bidder has, before submitting any bid, read and shall take full responsibility for all addenda, posted decisions, and other information relevant to the bid posted by the City on the Contractor's Bulletin Board. The Contractor's Bulletin Board is located at 201 W. Colfax, 2<sup>nd</sup> Floor, Denver, CO 80202, in the Wellington E. Webb Municipal Office Building.

#### **IB-13 PRE-BID MEETING**

Bidders are urged to attend the pre-bid meeting(s) scheduled for this Project. Attendance is not mandatory; however, bidders will be held responsible for all information presented at such meeting(s).

#### IB-14 ADDENDA

As its best interests may require, the City may issue addenda to the Contract Documents. Such addenda shall be posted on the Contractor's Bulletin Board and made available to all persons having purchased a set of Contract Documents as set forth in the Notice of Invitation for Bids contained herein. All bidders must acknowledge receipt of all addenda on the Bid Form at the time of submission of the bid.

Contract No. 201206436 DPD CVG

#### **IB-15 BID OPENING**

Bidders are invited to be present at the bid opening. Unless otherwise suspended, delayed or canceled by posted notice from the Manager, bid opening will occur at the time and place designated in the Notice of Invitation for Bid.

#### **IB-16** EVALUATION OF BIDS AND BASIS OF BID SELECTION

Bids will be evaluated after being read in open meeting at the place designated for such bid opening. All low bidders' bids will be reviewed for responsiveness to the requirements of the Contract Documents and whether or not the bids contain irregularities which could give any bidder an unfair advantage.

Selection will be made on the basis of the lowest, total, responsive, qualified bid, which bid shall include the total base bid set forth on the Bid Form, plus the total of any alternates set forth on the Bid Form and selected by the City during evaluation. Alternates, if any are included in the bid, will be selected in the priority shown on the Bid Form, subject to the limits of available funds. Bid selection will be subject to all requirements and special bidder qualifications contained herein and subject to approval of such resulting Contract in accordance with the Charter and Revised Municipal Code of the City and County of Denver. In addition to all other specified requirements, the City will correct arithmetical errors in all bids and corrected totals only will be considered as the basis of selection.

Upon concluding that the bid is, in fact, the lowest, total, responsive bid to the bidding conditions and that of a responsible, qualified bidder, the City will notify the Apparent Low Bidder.

As its best interests may appear, the City and County of Denver reserves the right to waive informalities in bids, to reject any and all bids and to rebid the Project.

#### **IB-17** NOTICE TO APPARENT LOW BIDDER

The Notice to Apparent Low Bidder, a form of which is included in the Contract Special Conditions Section of the Contract Documents, is issued by the City directly to the selected bidder and informs the bidder that the Manager intends to seek approval of the execution of the Contract by the City in accordance with the Charter and Revised Municipal Code of the City and County of Denver. Specifically, it informs the bidder of its obligations with respect to execution of the Contract and instructs the bidder on how to proceed toward execution of the Contract. The City reserves the right to notify the Apparent Low Bidder, at any time within one hundred twenty (120) days from the date of the opening of the bids, that approval to contract with the Apparent Low Bidder shall be sought in accordance with the Charter and Revised Municipal Code of Denver.

In accordance with the terms and conditions contained in the Bid Form and Submittal Package and any additional requirements set forth in the Notice to Apparent Low Bidder or elsewhere in the Contract Documents, the Apparent Low Bidder shall execute the Contract Form contained in the bound sets of Contract Documents made available by the City for execution in the appropriate number of counterparts. The Apparent Low Bidder shall return the fully executed Contract Document sets, along with any supplemental documents required herein, to the City and shall comply with all other conditions precedent to Contract execution within five (5) days of the date of issuance of the Notice to Apparent Low Bidder by the City shall render the bid nonresponsive and may constitute cause for rejection.

Issuance of such Notice shall not, however, constitute a commitment on the part of the City or create any rights in the Apparent Low Bidder to any contract with the City.

#### **IB-18 EXECUTION OF CONTRACT**

The process of executing a contract requires action by both the apparent low bidder and the City. After it notifies the Apparent Low Bidder, the City will prepare sufficient copies of the Contract Documents by incorporating all of the documents submitted by the Apparent Low Bidder into executable copies of the Contract Documents made available pursuant to the Notice of Invitation for Bids. These copies will then be made available to the Apparent Low Bidder who shall thereafter properly sign all of the copies. At this

Contract No. 201206436 DPD CVG time, the successful bidder shall also provide certain supplemental documents for incorporation into the Contract Documents. These supplemental documents shall include: the properly executed Certificate of Insurance Forms evidencing the apparent low bidder's satisfactory compliance with the insurance requirements set forth in the Contract Documents; a properly executed Payment and Performance Bond Form and appropriate Power of Attorney evidencing the Apparent Low Bidder's satisfactory compliance with the bonding requirements set forth in the Contract Documents; and documentation of compliance with any other conditions precedent to execution of the Contract by the City set forth in the Contract Documents. The insurance and bond forms contained in the Contract Special Conditions Section of the Contract Documents must be used in satisfying these supplemental document requirements.

These documents are then delivered to the City within the prescribed time period for examination of the documents to determine whether or not the Contractor has correctly executed the Contract and has correctly provided the required supplemental documents and that these documents are satisfactorily and properly completed. From here, all of the documents are forwarded to the City Attorney who will, if the insurance and bonding offered is acceptable and if all other elements of the Contract Documents are in order, recommend that the Manager and the Mayor approve the documents and, when required by the City Charter, prepare an ordinance for submittal to City Council authorizing the execution of the Contract. The City Attorney shall in all applicable instances submit the proposed contract and ordinance to City Council. After City Council approval, the Contract shall be reviewed by the City Attorney and routed for execution by the Mayor, the Clerk for attestation and the Auditor for countersignature and registration. When the total process of contract execution is complete, a Notice to Proceed will be issued and a single executed copy of the Contract will be delivered to the Contractor. Any work performed or materials purchased prior to the issuance of Notice to Proceed is at the Contractor's risk.

#### **IB-19 BONDING REQUIREMENTS**

In accordance with the provisions of General Contract Conditions, Title 15, PERFORMANCE AND PAYMENT BONDS, the minimum bonding requirements for this Contract are set forth in the form **CITY AND COUNTY OF DENVER PERFORMANCE AND PAYMENT BOND** contained in the Special Conditions Section of the Contract Documents. Upon receipt of Notice to Apparent Low Bidder, the apparent low bidder must cause this form bond to be purchased, executed and furnished, along with appropriate Powers of Attorney and a surety authorization letter (in form similar to the one attached), to the City in accordance with the instructions contained herein.

#### **IB-20 INSURANCE REQUIREMENTS**

The minimum insurance requirements for this Contract are set forth in the Special Conditions Section of the Contract Documents. Bidders are urged to consider, in preparing a bid hereunder, that each condition, requirement or specification set forth in the form certificate must be complied with by the Contractor and all subcontractors performing Work on the Project, unless such requirements are specifically accepted in writing by the City's Risk Management Office. The Contractor must either include all subcontractors performing work hereunder as insureds under each required policy or furnish a separate certificate for each subcontractor. In either case, the Contractor shall insure that each subcontractor complies with all of the coverage requirements.

#### **IB-21 PERMITS AND LICENSES**

All permits, licenses and approvals required in the prosecution of the work shall be obtained and paid for by the Contractor.

#### **IB-22** WAGE RATE REQUIREMENTS

In preparing any bid hereunder, the Contractor must comply with and should carefully consider all requirements and conditions of the City's Payment of Prevailing Wages Ordinance, Sections 20-76 through 20-79, D.R.M.C. and any determinations made by the City pursuant thereto.

At the time of the preparation of the Contract Documents, the then-current prevailing wage rates applicable to this Project shall be bound within the Contract Documents made available to potential bidders for the Project. If, more than ten (10) days prior to the actual date of bid opening, the Career Service Board determines that prevailing wages rates different from those bound in the Contract Documents are applicable to one or more of the various classes of laborers, mechanics and workers encompassed by this Project, such

different prevailing wage rates shall be provided in an addendum. If different prevailing wage rates are determined by the Career Service Board ten (10) or less days prior to the actual date of bid opening, the City will determine on a case by case basis in its sole discretion whether such different prevailing wage rates are to be included in an addendum. In conjunction with such determination, the City may elect, in its sole discretion, to postpone the date of bid opening on the Project. In any event, the bidder will be held, at the actual date of bid opening, to those prevailing wage rates incorporated into the Contract Documents and as modified by any such addenda.

These prevailing wage rates shall be considered the **minimum** City prevailing wage rates to be paid by all contractors or subcontractors for a period not to exceed one (1) year from the date of the Contract. Increases in prevailing wages subsequent to the date of the Contract for a period not to exceed one (1) year shall not be mandatory on either the contractor or subcontractors. Future increases in prevailing wages on contracts whose period of performance exceeds one (1) year shall be mandatory for the contractor and subcontractors only on the yearly anniversary date of the Contract. The **minimum** City prevailing wage rate for any such subsequent yearly period or portion thereof shall be the wage rates in effect on the yearly anniversary date of the contract. In no event shall any increases in prevailing wages over the amounts thereof as stated in such Technical Specifications and addenda thereto result in any increased liability on the part of the City and the possibility and risk of any such increase is assumed by all contractors entering into any such contract with the City. Decreases in prevailing wages subsequent to the date of the contract for a period not to exceed one year (1) shall not be permitted. Decreases in prevailing wages on contracts whose period of performance exceeds one (1) year shall not be effective except on the yearly anniversary date of the contract for a period not to exceed one year (1) shall not be permitted.

#### **IB-23 TAX REQUIREMENTS**

<u>General</u>. Bidders are referred to the General Contract Condition 322, TAXES, as to taxes to which they may be subject in performing the Work under this Contract, including but not limited to sales and use taxes and the Denver Occupational Privilege Tax. The following instructions are to be considered along with the General Contract Conditions and not in lieu of them.

<u>Sales and Use Tax</u>. Construction and building materials sold to contractors and subcontractors for use on structures, roads, streets, highways, and other public works owned by the City and County of Denver are exempt from state, RTD, and Cultural Facilities District sales and use taxes. However, such materials will be subject to sales and use taxes imposed by the City and County of Denver.

It is the responsibility of the Contractor and its subcontractors to apply to the Colorado Department of Revenue ("CDOR") for a certificate, or certificates, of exemption indicating that their purchase of construction or building materials is for a public project, and to deliver to the City copies of such applications as soon as possible after approval by the CDOR. Bidders shall not include in their bid amounts the exempt state, RTD, and Cultural Facilities District Sales and Use Taxes.

<u>Denver Occupational Privilege Tax</u>. Any employee working for a contractor, or a subcontractor, who earns over \$500 working in Denver during a calendar month, is subject to the payment of the Employee Occupational Privilege Tax. The Contractor and any subcontractor must pay the Business Occupational Privilege Tax for each of its employees who are subject to such tax.

#### **IB-24 DISCLOSURE OF PRINCIPALS**

Pursuant to D.R.M.C. 20-69, any bid in excess of \$100,000.00 must be accompanied by a separate detachable page setting forth the following information:

(1) The name of any officer, director, owner or principal of the business entity, including identity of any shareholder who owns or controls 5% or more of the business entity, and either 1) the names of his or her spouse, and children under eighteen years of age; or 2) a statement that he or she or his or her spouse, or children, if any, under the age of eighteen have or have not made a contribution, as defined in D.R.M.C. 15-32, or contribution in kind, as defined in D.R.M.C. 15-32, to any candidate, as defined in D.R.M.C. 15-32, during the last five years and identifying by name himself or herself or any spouse or child under the age of eighteen who has made such a contribution or contribution in-kind to a candidate.

(2) The names of any subcontractors or suppliers whose share of the bid exceeds \$100,000.00 of the contract or formal bid amount.

(3) The names of any unions with which the bidder has a collective bargaining agreement.

If the total bid amount is in excess of \$500,000.00, the information required in (1) above must be provided at the time of bid submittal, and the information required in (2) and (3) must be submitted in a timely fashion prior to award. The list of subcontractors required by this instrument is different and separate from the bidding list required on BF-4.

If the total bid amount is less than \$500,000.00 but more than \$100,000.00, such information must be provided prior to award of the contract. Failure to provide the required information in a timely fashion shall render any bid to which D.R.M.C. 20-69 applies non-responsive.

While a bidder or supplier who has already disclosed such information need not provide such information with a second or subsequent bid or proposal unless such information has changed, it shall be the responsibility of each such bidder or proposer to verify that such information is still current as of the date of such subsequent bid or proposal and is in fact on file with the City Clerk.

A form, which may be used for such disclosure, is contained in the Special Conditions Section of the Contract Documents. The form is entitled: Bidder/Contractor/Vendor/Proposer Disclosure. Failure to provide or update the required information in a timely fashion shall render any bid to which D.R.M.C. 20-69 applies non-responsive.

#### IB-25 MINORITY AND WOMAN BUSINESS ENTERPRISE (M/WBE) REQUIREMENTS

Article III, Divisions 1 and 3 of Chapter 28, Denver Revised Municipal Code (D.R.M.C.), designated as Sections 28-31 - 29-36 and 28-52 - 28-90 D.R.M.C. and referred to in these Bid Documents as the "M/WBE Ordinance" and any Rules or Regulations promulgated pursuant thereto apply to this Project and are incorporated into these Bid Documents by reference. Generally, the M/WBE Ordinance provides for the adoption of a good faith goals program, to be administered by the Division of Small Business Opportunity (DSBO), devised to provide increased bidding opportunities for Minority and Woman Business Enterprises (M/WBEs). As such, each bidder must comply with the terms and conditions of the M/WBE Ordinance in making its bid and, if awarded the Contract, in performing all Work thereunder. A bidder's failure to comply with the M/WBE Ordinance, any Rules or Regulations promulgated pursuant thereto, or any additional requirement contained herein shall render the bid non-responsive and shall constitute cause for rejection. Failure by the contractor awarded the contract to comply with M/WBE Ordinance requirements during the performance of the contract is a material breach of the contract, which may result in the in the imposition of sanctions on the Contractor, as deemed appropriate by DSBO. Copies of the M/WBE Ordinance and its accompanying Rules and Regulations are available for the use and review of bidders from DSBO. In order to comply with the bid requirements of the M/WBE Ordinance, a bidder shall either meet the established project goal or, in the alternative, demonstrate that the bidder has made sufficient good faith efforts to meet the goal in accordance with the M/WBE Ordinance.

#### Meeting Established Goal

In preparing a bid to meet the established Project goal, bidders should consider the following instructions relating to compliance with the M/WBE Ordinance:

- 1. Under the M/WBE Ordinance, the Director of DSBO ("Director") is directed to establish project goals for expenditures on construction, reconstruction, and remodeling work performed for the City and County of Denver. The specific goal for this project is stated in the Notice of Invitation for Bids bound herein.
- 2. In preparing its bid, each bidder shall list on the Bid Form pages entitled "List of Proposed MWBE or DBE Bidders, Subcontractors, Suppliers (Manufacturers) or Brokers" the name, address, work description/supply, committed level of participation and other required information for each M/WBE of any tier which the bidder intends to use in performing the work on this Project. Only the M/WBEs identified and the precise levels of participation listed for each on the Bid Form page, at the time of bid opening, will be considered in determining whether the bidder has met the designated

participation goal. Additional, revised or corrected participation submitted after bid opening will not be considered. M/WBE bidders may count self-performance or joint venture activity in meeting the M/WBE project goal, but only for the scope of work performed as a commercially useful function and at a percentage level the M/WBE will be performing itself.

- 3. If a bidder/proposer is participating in a joint venture with a certified M/WBE firm, complete the "Joint Venture Eligibility Form" and "Joint Venture Affidavit" contained in this bid document/RFP. Submit the aforementioned forms with the firm's Joint Venture Agreement, to the DSBO Director, <u>at least 10</u> working days prior to the proposal submittal. The Joint Venture must be approved prior to the bid opening or proposal submittal by the DSBO Director. Approval by the DSBO Director includes determining the amount the Joint Venture will count towards meeting the project goal.
- 4. All M/WBEs listed on the Bid Form must be properly certified by the City on or before the date bids are opened in order to count towards meeting the designated goal. DSBO maintains a M/WBE Directory ("Directory"), which is a current listing of M/WBEs that have been certified by the City. A copy of the DSBO Directory is located at DSBO web site at: DSBO Compliance . Bidders are encouraged to use the Directory to assist in locating M/WBEs for the work and supplies required on the Project. Bidders are reminded that changes may be made to the Directory at anytime in accordance with the City's M/WBE Ordinance and procedures established to administer this program and a current copy of the Directory must always be used in preparing a bid. M/WBE certification or listing in the Directory is not a representation or warranty by the City as to the qualifications of any listed M/WBE.
- 5. In accordance with the provisions of the M/WBE Ordinance, DSBO will evaluate each bid to determine the responsiveness of the bid to the requirements of the M/WBE Ordinance. In determining whether a bidder's committed level of participation meets or exceeds the stated M/WBE goal, DSBO shall base its calculation of applicable amounts and percentages on the total base bid amount, not including any listed alternates, of each bid as follows:

a. The bid information provided by the agency will be used to determine the total base bid amount of each bid. Each bidder's total base bid amount will be multiplied by the M/WBE percentage established for the project to determine the exact dollar amount of required M/WBE participation for the Project. This amount will then be compared against the exact dollar amounts for the M/WBE committed for participation by the bidder. If the total dollar amount of participation listed meets or exceeds the established M/WBE dollar amount goal listed, then DSBO will determine that the goal has been met.

b. In addition, DSBO will determine the exact commitment percentage for each listed M/WBE by dividing the dollar amount listed for each M/WBE by the total base bid dollar amount submitted by the bidder. These individual percentages, when totaled for all listed M/WBE, will establish the total committed percentage level of M/WBE participation that the bidder must comply with during the life of the contract. In all cases, the committed percentage level of M/WBE participation must equal or exceed the assigned M/WBE goal for the Project.

c. In providing the exact dollar amount of participation for each listed M/WBE, a bidder should take care never to round up in determining whether or not the total of these amounts meets or exceeds the established percentage goal. The goal must be met or exceeded by dollar amounts and percentages in order for DSBO to determine that the bidder has met or exceeded the applicable M/WBE goal.

d. As previously mentioned, compliance with the M/WBE goal will be determined on the base bid alone. If a bid contains alternates, participation contained in any alternate will not count towards satisfaction of the Project goal. However, should any designated alternate be selected by the City for inclusion in the contract ultimately awarded, the M/WBE goal percentage level submitted at bid time, on the base bid, will also apply to the selected alternate work. Thus, even though such participation will not be considered in evaluating bids, bidders are urged to consider participation in preparing bids for designated alternates.

e. On projects where force account or allowance bid items have been included, bidders must meet the M/WBE goal percentage based upon the total base bid, including all such items that are submitted to the City. However, when a force account or allowance is designated by the City to be either performed or purchased from a specific company, the bidder may back out the dollar amount of the force account or allowance from the total base bid and meet the M/WBE goal on the remaining reduced amount.

f. On bids which, at the time of bid opening, are equal to or exceed Five Million Dollars (\$5,000,000.00), including any alternates which may be selected, only sixty percent (60%) of the value of the commercially useful function performed by M/WBE suppliers shall count toward satisfaction of the Project goal. On Projects under Five Million (\$5,000,000.00) the value of the commercially useful function of M/WBE supplier(s) will count at a one hundred percent (100%) level. Manufacturer's representatives and packagers shall be counted in the same manner as brokers.

g. In utilizing the M/WBE participation of a Broker only the bona fide commissions earned by such Broker for its performance of a commercially useful function will count toward meeting the Project goals. The bidder must separate the bona fide brokerage commissions from the actual cost of the supplies or materials provided to determine the actual dollar amount of participation that can be counted towards meeting the goal.

On or before the third (3rd) working day after bid opening, all of the Bidders are required to submit an 6. executed "Letter of Intent" for each M/WBE listed on the Bid Form as a joint venture member, subcontractor, supplier, manufacturer, manufacturers' representative or broker of any tier. A MBE or WBE Prime Bidder needs to submit a Letter of Intent for itself for self-performed work and must identify their level of participation on the designated M/WBE participation page bound herein. A Letter of Intent shall be submitted only for the M/WBEs listed at the time of bid opening, since this is the only participation that will be counted toward satisfaction of the project goal. A form for the M/WBE Letter of Intent is included with the Bid Form. The M/WBE Letter of Intent is a written communication from the Bidder to the City evidencing an understanding that the Bidder has or will enter into a contractual relationship with the M/WBE or that its subcontractor(s) and supplier(s), manufacturer(s), manufacturers' representative(s) and broker(s) will do so. Each M/WBE Letter of Intent shall be accompanied by a copy of the City and County of Denver's M/WBE certification letter for each proposed M/WBE identified at bid time. Bidders are urged to carefully review these Letters before submission to the City to ensure that they are properly completed and executed by the appropriate parties.

#### Good Faith Effort.

In preparing a bid to demonstrate a good faith effort, bidders should consider the following instructions relating to compliance with the M/WBE Ordinance:

- 1. If the bidder or proposer has not fully met the project goal as provided in section 28-60, then it shall demonstrate that it has made good faith efforts to meet such goal. The bidder or proposer shall furnish to the director, within three (3) working days after bid opening by the City or on or before the time of the final project-specific proposal submitted to and authorized by the City pursuant to a competitive selection process, or bid selection by a private owner, a detailed statement of its good faith efforts to meet the project goal set by the director. This statement shall address each of the items in subsection (b) and any additional criteria that the director may establish by rule or regulation consistent with the purposes of this Division 3. Good faith efforts must be demonstrated to be meaningful and not merely for formalistic compliance with this Division 3. The scope and intensity of the efforts will be considered in determining whether the bidder or proposer has achieved a good faith effort.
- 2. The statement of good faith efforts shall include a specific response and verification with respect to each of the following good faith effort categories, which may be further defined by rule or regulation. A bidder or proposer may include any additional information it believes may be relevant. Failure of a bidder or proposer to show good faith efforts as to any one (1) of the following categories shall render its overall good faith effort showing insufficient and its bid or proposal non-responsive:
  - a. If prebid or preselection meetings are scheduled by the City at which MBEs and WBEs may be informed of subcontracting or joint venture opportunities under a proposed contract to be bid, or procured pursuant to the competitive selection process, attendance at such prebid or preselection

meetings is not mandatory; however, bidders and proposers are responsible for the information provided at these meetings.

- b. The bidder or proposer must solicit through all reasonable and available means, the interest of all MBEs and WBEs certified in the scopes of work of the contract. The bidder or proposer must solicit the interest of such MBEs and WBEs within sufficient time, prior to the bid opening or date of final project-specific proposal in the case of a competitive selection process, to allow such MBEs and WBEs to respond to the solicitation. The bidder or proposer must determine with certainty if the MBEs and WBEs are interested by demonstrating appropriate steps to follow up initial solicitations.
- c. The bidder or proposer must select portions of the work of the contract to be performed by MBEs and WBEs in order to increase the likelihood that the project goal will be achieved. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate MBE and WBE participation as subcontractors or joint venturers, and for bidder or proposer self-performed work, as suppliers, manufacturers, manufacturer's representatives and brokers, all reasonably consistent with industry practice, even when the bidder or proposer would otherwise prefer to perform these work items with its own forces. The bidder or proposer must identify what portions of the contract will be self-performed and what portions of the contract not self-performed must be solicited for MBE and WBE participation. The ability or desire of a bidder or proposer to perform the work of a contract with its own forces does not relieve the bidder or proposer of the responsibility to meet the project goal or demonstrate good faith efforts to do so.
- d. The bidder or proposer, consistent with industry practice, must provide MBEs and WBEs at a clearly stated location with timely, adequate access to and information about the plans, specifications, and requirements of the contract, including bonding and insurance requirements, if any, to assist them in responding to a solicitation.
- e. The bidder or proposer must negotiate in good faith with interested MBEs and WBEs and provide written documentation of such negotiation with each such MBE or WBE.
- f. For each MBE or WBE which contacted the bidder or proposer or which the bidder or proposer contacted or attempted to subcontract or joint venture with, consistent with industry practice, the bidder or proposer must supply a statement giving the reasons why the bidder or proposer and the MBE or WBE did not succeed in negotiating a subcontracting, supplier, manufacturer, manufacturer's representative, broker or joint venture agreement, as applicable.
- 3. The bidder or proposer must provide verification that it rejected each non-utilized MBE and WBE because the MBE or WBE did not submit the lowest bid or it was not qualified. Such verification shall include a verified statement of the amounts of all bids received from potential or utilized subcontractors, suppliers, manufacturers, manufacturer's representatives, brokers or joint venturers on the contract, whether or not they are MBEs or WBEs. In making such a determination of not being qualified, the bidder or proposer shall be guided by the definition of qualified in section 28-54(42), but evidence of lack of qualification must be based on factors other than solely the amount of the MBE's or WBE's bid. For each MBE or WBE found not to be qualified by the bidder or proposer, the verification shall include a statement giving the bidder's or proposer's reasons for its conclusion. A bidder's or proposer may not reject an MBE or WBE as being unqualified without sound reasons based on a reasonably thorough investigation and assessment of the MBE's or WBE's capabilities and expertise.
- 4. If requested by a solicited MBE or WBE, the bidder or proposer must make reasonable efforts to assist interested MBEs and WBEs in obtaining bonding, lines of credit, or insurance as required by the City or by the bidder or proposer, provided that the bidder or proposer need not provide financial assistance toward this effort.

- 5. If requested by a solicited MBE or WBE, the bidder or proposer must make reasonable efforts to assist interested MBEs and WBEs in obtaining necessary and competitively priced equipment, supplies, materials, or related assistance or services for performance under the contract, provided that the bidder or proposer need not provide financial assistance toward this effort.
- 6. The bidder or proposer must use the DSBO MBE/WBE directories to identify, recruit, and replace MBEs and WBEs.
- 7. In determining whether a bidder or proposer has satisfied good faith efforts as to a project goal, the success or failure of other bidders or proposers on the contract in meeting such project goal may be considered.

#### **Continuing Commitments.**

In accordance with the provisions of the M/WBE Ordinance, the bidder agrees that it is committed to meeting either the M/WBE participation goal or the M/WBE participation set forth in its statement of good faith. This commitment must be expressly indicated on the "Commitment to MWBE SBE Participation" form included with the Bid Form. This commitment includes the following understandings:

- 1. The bidder understands it must maintain M/WBE goals throughout the performance of the Contract pursuant to the requirements set out in D.R.M.C. 28-72.
- 2. The bidder understands that it must establish and maintain records and submit regular reports, as required, which will allow the City to assess progress in achieving the M/WBE participation goal.
- 3. The bidder understands that if change orders or any other contract modifications are issued under the contract, the bidder shall have a continuing obligation to immediately inform DSBO in writing of any agreed upon increase or decrease in the scope of work of such contract, upon any of the bases discussed in Section 28-73 of the M/WBE Ordinance, regardless of whether such increase or decrease in scope of work has been reduced to writing at the time of notification.
- 4. The bidder understands that if change orders or other contract modifications are issued under the contract, that include an increase in scope of work of a contract for construction, reconstruction, or remodeling, whether by amendment, change order, force account or otherwise which increases the dollar value of the contract, whether or not such change is within the scope of work designated for performance by an M/WBE at the time of contract award, such change orders or contract modification shall be immediately submitted to DSBO for notification purposes. Those amendments, change orders, force accounts or other contract modifications that involve a changed scope of work that cannot be performed by existing project subcontractors or by the contractor shall be subject to a goal for M/WBEs equal to the original goal on the contract which was included in the bid. The contractor shall satisfy such goal with respect to such changed scope of work by soliciting new M/WBEs in accordance with Section 28-73 of the M/WBE Ordinance as applicable, or the contractor must show each element of modified good faith set out in Section 28-75(c) of the M/WBE Ordinance with respect to the increased dollar value of the contract.

All bidders are charged with knowledge of and are solely responsible for complying with each and every provision of the M/WBE Ordinance in making a bid and, if awarded, in performing the work described in the Contract Documents. Failure to comply with these provisions could constitute cause for rejection of a bid or subject the selected contractor to sanctions set forth in the M/WBE Ordinance. These instructions are intended only to generally assist the bidder in preparing and submitting a compliant bid. Should any questions arise regarding specific circumstances, bidders must consult the M/WBE Ordinance or contact the Project's designated DSBO representative at (720) 913-1999.

#### **IB-26 DISCLOSURE OF INFORMATION**

All submissions and other materials provided or produced pursuant to this Invitation for Bids may be subject to the Colorado Open Records Law, C.R.S. 24-72-201, et seq. As such, bidders are urged to review these disclosure requirements and any exceptions to disclosure of information furnished by another party and, prior to submission of a bid to the City, appropriately identify materials that are not subject to disclosure. In the event of a request to the City for disclosure of such information, the City shall advise the

Contract No. 201206436 DPD CVG - bidder of such request to give the bidder an opportunity to object to the disclosure of designated confidential materials furnished to the City. In the event of the filing of a lawsuit to compel such disclosure, the City will tender all such material to the court for judicial determination of the issue of disclosure and each bidder agrees to intervene in such lawsuit to protect and assert its claims of privilege against disclosure of such material. Each bidder further agrees to defend, indemnify and save and hold harmless the City, its officers, agents and employees, from any claim, damages, expense, loss or costs arising out of the bidder's intervention to protect and assert its claims of privilege against disclosure under the Open Records Law including, but not limited to, prompt reimbursement to the City of all reasonable attorney fees, costs and damages that the City may incur directly or may be ordered to pay by such court.

#### **IB-27** GENERAL BIDDING INFORMATION

Bidders are instructed to contact the Contract Administrator designated below for this Project for pre-bid, post-bid and general City bidding information. Bidders can also visit DenverGov.com for information, both general and project specific. The Contract Administrator assigned to this project is Toni Green who can be reached via email at toni.green@denvergov.org.

#### RULES AND REGULATIONS REGARDING EQUAL EMPLOYMENT OPPORTUNITY

Promulgated and adopted by the Manager of Public Works pursuant to and by authority of Article III, Division 2, Chapter 28 of the Revised Municipal Code of the City and County of Denver, and for the purpose of insuring that contractors, subcontractors and suppliers soliciting and receiving compensation for contract work from or through the City and County of Denver provide equal opportunity in employment without regard to race, color, creed, sex, national origin, age, religion, marital status, political opinion or affiliation or mental or physical handicap and meet certain requirements for the hiring, training, promotion, and treatment during employment of members of ethnic groups subject to differential treatment, including persons of African descent (Black), Spanish-surnamed (Hispanic), Asian-American and American Indian Groups.

#### **RULE I - DEFINITIONS**

- A. "City" means the City and County of Denver.
- B. "Manager" shall mean the Manager of Public Works for the City and County of Denver.
- C. "Contract" means a contract entered into with the City and County of Denver, financed in whole or in part by local resources or funds of the City and County of Denver, for the construction of any public building or prosecution or completion of any public work.
- D. "Contractor" means the original party to a contract with the City and County of Denver, also referred to as the "general" or "prime" contractor.
- E. "Director" means the Director of the Division of Small Business Opportunity.
- F. "Subcontractor" means any person, company, association, partnership, corporation, or other entity, which assumes by subordinate agreement some or all of the obligations of the general or prime contractor.
- G. The phrase "Bidding Specifications" as used in Article III, Division 2 of Chapter 28 of the Revised Municipal Code shall include BID CONDITION, INVITATION TO BID, and NOTICE OF PROPOSAL.
- H. "Affirmative Action Program" means a set of specific and result-oriented procedures or steps to which a contractor commits himself to apply every good faith effort to employ members of ethnic minority groups, to include persons of African descent (Black), Spanish surnamed (Hispanic), Asian-American, American Indians, and persons with mental or physical handicap.
- I. "Division of Small Business Opportunity" means the City agency established pursuant to Article III, Division 1 of Chapter 28 of the Denver Revised Municipal Code.

#### **RULE II - NOTICE OF HEARING**

When results of conciliation efforts are unsatisfactory to the Manager and he is informed in accordance with Article III, Division 2 of Chapter 28 of the Revised Municipal code that a contractor or subcontractor has apparently failed to meet affirmative action and equal employment opportunity requirements after a reasonable period of notice to correct deficiencies, the Manager will, prior to imposition of any sanctions, afford the general contractor a hearing in order to determine whether the contractor or his subcontractors have failed to comply with the affirmative action and equal employment opportunity requirements of Chapter 28 of the Revised Municipal Code or of the contract. Written notice of such hearing shall be delivered personally or sent by certified mail, return receipt requested, to the contractor and to any subcontractor involved, at least ten (10) days prior to the date scheduled for the hearing.

#### RULE III - HEARING

- A. Contractors will appear at hearings and may be represented by counsel, and may present testimony orally and other evidence.
- B. Hearings shall be conducted by one or more hearing examiners designated as such by the Manager.
- C. The Director of the Division of Small Business Opportunity may participate in hearings as a witness.
- D. Hearings shall be held at the place specified in the notice of hearing.
- E. All oral testimony shall be given under oath or affirmation and a record of such proceedings shall be made.
- F. All hearings shall be open to the public.

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G. The hearing officer shall make recommendations to the Manager who shall make a final decision.

#### REGULATIONS

#### **REGULATION NO. 1 - ORDINANCE:**

The Rules and Regulations of the Manager shall be inserted in the bidding specifications for every contract for which bidding is required.

#### **REGULATION NO. 2 - EXEMPTIONS:**

Each contract and subcontract, regardless of the dollar amount, shall be subject to affirmative action requirements unless specifically exempted in writing individually by the Manager. Exemptions apply only to "affirmative action" in equal employment opportunity, and are not to be construed as condonation in any manner of "discrimination" or "discriminatory practices" in employment because of race, color, creed, sex, age, national origin, religion, marital status, political opinion or mental or physical handicap.

#### **REGULATION NO. 3 - DIRECTOR OF CONTRACT COMPLIANCE:**

The Director of the Division of Small Business Opportunity shall perform the duties assigned to such official by Article III, Division 2 Chapter 28 of the Revised Municipal Code and by the Manager. (1) The Director of the Division of Small Business Opportunity or designated representatives shall inform bidders and contractors of affirmative action procedures, programs, and goals in accordance with the Ordinance at pre-bid and pre-construction conference; (2) make regular on-site inspections; (3) supply contractors and subcontractors with report forms to be completed by them when requested, and furnished to the Director of the Division of Small Business Opportunity; and (4) review payroll records, employment records and practices of general contractors and their subcontractors and suppliers during the performance of any contract. The Director of the Division of Small Business to the Manager.

#### **REGULATION NO. 4 - GOALS AND TIMETABLES:**

In general, goals and timetables should take into account anticipated vacancies and the availability of skills in the market place from which employees should be drawn. In addition, where discrimination in employment by a general contractor or any of his subcontractors is indicated, a corrective action program will take into account the need by the general contractor and his subcontractors to correct past discriminatory practices and reach goals of minority manpower utilization on a timely basis through such recruiting and advertising efforts as are necessary and appropriate.

#### **REGULATION NO. 5 - AWARD OF CONTRACTS:**

It shall be the responsibility of the Director of the Division of Small Business Opportunity to determine the affirmative action capability of bidders, contractors and subcontractors and to recommend to the Manager the award of contracts to those bidders, contractors and subcontractors and suppliers who demonstrate the ability and willingness to comply with the terms of their contract.

#### **REGULATION NO. 6 - PUBLICATION AND DUPLICATION:**

Copies of these Rules and Regulations as amended by the Manager from time to time, shall as soon as practicable and after Notice being published will be made a part of all City Contracts.

#### **REGULATION NO. 7 - NOTICE TO PROCEED:**

Prior to issuance of the Notice to Proceed, a sign-off will be required of the Director of the Division of Small Business Opportunity or his designee.

#### **REGULATION NO. 8 - CONTRACTS WITH SUBCONTRACTORS:**

To the greatest extent possible, the contractor shall make a good faith effort to contract with minority contractors, subcontractors and suppliers for services and supplies by taking affirmative actions, which include but are not limited to the following:

- 1. Advertise invitations for subcontractor bids in minority community news media.
- 2. Contact minority contractor organizations for referral of prospective subcontractors.
- 3. Purchase materials and supplies from minority material suppliers.

#### **REGULATION NO. 9 - AGENCY REFERRALS:**

It shall be no excuse that the union with which the contractor or subcontractor has an agreement providing for referral, exclusive or otherwise, failed to refer minority employees.

#### **REGULATION NO. 10 - CLAUSES:**

The Manager shall include the appropriate clauses in every contract and the contractor shall cause to be inserted in every subcontract the appropriate clauses:

- 1. APPENDIX A: City and County of Denver Equal Opportunity Clause ALL CONTRACTS funded only with City and County of Denver monies.
- 2. APPENDIX B: Equal Opportunity Clause (11246) ALL FEDERAL ASSISTED.
- 3. APPENDIX C: Section 3 Assurance of Compliance HUD ASSISTED PROJECTS.
- 4. APPENDIX D: Section 3 Clause HUD ASSISTED PROJECTS.

All amendments to the appendices shall be included by reference.

#### **REGULATION NO. 11 - SHOW CAUSE NOTICES:**

When the Manager has reasonable cause to believe that a contractor has violated Article III, Division 2 of Chapter 28 of the Denver Revised Municipal Code, he may issue a notice requiring the contractor to show cause, within fifteen (15) days why enforcement procedures, or other appropriate action to insure compliance, should not be instituted.

#### **REGULATION NO. 12 - BID CONDITIONS - AFFIRMATIVE ACTION REQUIREMENTS - EQUAL EMPLOYMENT OPPORTUNITY:**

- 1. APPENDIX E: The Bid Conditions Affirmative Action Requirements Equal Employment Opportunity as amended and published by the U.S. Department of Labor Employment Standards Administration, Office of Federal Contract Compliance, shall be inserted verbatim for bidding specification for every non-exempt contract involving the use of Federal funds.
- 2. APPENDIX F: The Bid Conditions Affirmative Action Requirements Equal Employment Opportunity as published by the Department of Public Works, City and County of Denver, shall be inserted verbatim as bidding specifications for every non-exempt contract using City funds.

#### CITY AND COUNTY OF DENVER DEPARTMENT OF PUBLIC WORKS Engineering Division

#### APPENDIX A

#### CITY AND COUNTY OF DENVER EQUAL OPPORTUNITY CLAUSE -ALL CONTRACTS

The Contractor will not discriminate against any employee or applicant for employment because of race, creed, color, sex, age, national origin, religion, marital status, political opinion or affiliation, or mental or physical handicap. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, creed, color, sex, age, national origin, religion, marital status, political opinion or affiliation, or mental or gin, religion, marital status, political opinion or affiliation, or mental or physical handicap. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

- 2. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, sex, age, national origin, religion, marital status, political opinion or affiliation, or mental or physical handicap.
- 3. The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided, advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
- 4. Each Contractor will comply with all provisions of Article III, Division 2 of Chapter 28 of the Revised Municipal Code, and the rules, regulations, and relevant orders of the Manager and the Director.
- 5. The Contractor will furnish all information and reports required by Article III, Division 2 of Chapter 28 of the Revised Municipal Code, and by rules, regulations and orders of the Manager and Director or pursuant thereto, and will permit access to his books, records, and accounts by the Manager, Director, or their designee for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
- 6. In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations or orders, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further City contracts in accordance with procedures authorized in Article III, Division 2, Chapter 28 of the Revised Municipal Code, or by rules, regulations, or order of the Manager.
- 7. The Contractor will include Regulation 12, Paragraph 2 and the provisions of paragraphs (1) through (6) in every subcontract of purchase order unless exempted by rules, regulations, or orders of the Manager issued pursuant to Article III, Division 2, Chapter 28 of the Revised Municipal Code, so that such provisions will be binding on each subcontractor or supplier. The Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance.

The applicant further agrees to be bound by the above equal opportunity clauses with respect to its own employment practices when it participates in City contracts. The Contractor agrees to assist and cooperate actively with the Manager and the Director in obtaining compliance of subcontractors and suppliers with the equal opportunity clause and the rules, regulations and relevant orders of the Manager, and will furnish the Manager and the Director such information as they may require for the supervision of compliance, and will otherwise assist the Manager and Director in the discharge of the City's primary responsibility for

Contract No. 201206436 DPD CVG

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securing compliance. The Contractor further agrees to refrain from entering into any contract or contract modification subject to Article III, Division 2 of Chapter 28 of the Revised Municipal Code with a contractor debarred from, or who has not demonstrated eligibility for, City contracts.

The Contractor will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon contractors and subcontractors by the Manager and Director. In addition, the Contractor agrees that failure or refusal to comply with these undertakings the Manager may take any or all of the following actions:

- A. Cancellation, termination, or suspension in whole or in part of this contract.
- B. Refrain from extending any further assistance to the applicant under the program with respect to which the failure occurred until satisfactory assurance of future compliance has been received from such applicant.
- C. Refer the case to the City Attorney for appropriate legal proceedings.

**SUBCONTRACTS:** Each prime Contractor or Subcontractor shall include the equal opportunity clause in each of its subcontracts.

#### CITY AND COUNTY OF DENVER DEPARTMENT OF PUBLIC WORKS Engineering Division

#### APPENDIX F

#### **AFFIRMATIVE ACTION REQUIREMENTS**

#### EQUAL EMPLOYMENT OPPORTUNITY

For All Non-Exempt Construction Contracts to Be Awarded by the City and County of Denver, Department of Public Works.

#### **NOTICE**

EACH BIDDER, CONTRACTOR OR SUBCONTRACTOR (HEREINAFTER THE CONTRACTOR) MUST FULLY COMPLY WITH THE REQUIREMENTS OF THESE BID CONDITIONS AS TO EACH CONSTRUCTION TRADE IT INTENDS TO USE ON THIS CONSTRUCTION CONTRACT, AND ALL OTHER CONSTRUCTION WORK (BOTH CITY AND NON-CITY) IN THE DENVER AREA DURING THE PERFORMANCE OF THIS CONTRACT OR SUBCONTRACT. THE CONTRACTOR COMMITS ITSELF TO THE GOALS FOR MINORITY MANPOWER UTILIZATION, AS APPLICABLE, AND ALL OTHER REQUIREMENTS, TERMS AND CONDITION OF THESE BID CONDITIONS BY SUBMITTING A PROPERLY SIGNED BID.

THE CONTRACTOR SHALL APPOINT A COMPANY EXECUTIVE TO ASSUME THE RESPONSIBILITY FOR THE IMPLEMENTATION OF THE REQUIREMENTS, TERMS AND CONDITIONS OF THESE BID CONDITIONS.

/s/

Manager of Public Works City and County of Denver

Contract No. 201206436 DPD CVG

#### A. **REQUIREMENTS - AN AFFIRMATIVE ACTION PLAN:**

Contractors shall be subject to the provisions and requirements of these bid conditions including the goals and timetables for minority\* and female utilization, and specific affirmative action steps set forth by the Division of Small Business Opportunity (DSBO). The contractor's commitment to the goals for minority, and female utilization as required constitutes a commitment that it will make every good faith effort to meet such goals.

#### 1. GOALS AND TIMETABLES:

The goals and timetables for minority and female participation, expressed in percentage terms for the contractor's aggregate workforce in each trade are as follows:

| 21.7% - 23.5%          | 6.9%                 |
|------------------------|----------------------|
| Until Further Notice   | Until Further Notice |
| to                     | to                   |
| From January 1, 1982   | From January 1, 1982 |
| FOR EACH TRADE         | FOR EACH TRADE       |
| MINORITY PARTICIPATION | FEMALE PARTICIPATION |
| GOALS FOR              | GOALS FOR            |

The goals for minority and female utilization above are expressed in terms of hours of training and employment as a proportion of the total number of hours to be worked by the contractor's aggregate workforce, which includes all supervisory personnel, in each trade, on all projects for the City and County of Denver during the performance of its contract (i.e., The period beginning with the first day of work on the City and County of Denver funded construction contract and ending with the last day of work).

The hours of minority and female employment and training must be substantially uniform throughout the length of the contract in each trade and minorities and females must be employed evenly on each of a contractor's projects. Therefore, the transfer of minority or female employees from contractor to contractor or from project to project for the purpose of meeting the contractor's goals shall be a violation of these Bid Conditions.

If the Contractor counts the nonworking hours of apprentices they must be employed by the Contractor during the training period; the Contractor must have made a commitment to employ apprentices at the completion of their training subject to the availability of employment opportunities; and the apprentices must be trained pursuant to training programs approved by the Bureau of Apprenticeship and Training.

\* "Minority" is defined as including, Blacks, Spanish Surname Americans, Asian Americans, and American Indians, and includes both men and minority women.

#### 2. SPECIFIC AFFIRMATIVE ACTION STEPS:

No contractor shall be found to be in noncompliance solely on account of its failure to meet its goals, but will be given an opportunity to demonstrate that the contractor has instituted all the specific affirmative action steps specified and has made every good faith effort to make these steps work toward the attainment of its goals within the timetables, all to the purpose of expanding minority and female utilization in its aggregate workforce. A contractor, who fails to comply with its obligation under the Equal Opportunity Clause of its contract and fails to achieve its commitments to the goals for minority and female utilization has the burden of proving that it has engaged in an Affirmative Action Program directed at increasing minority and female utilization and that such efforts were at least as extensive and as specific as the following:

a. The Contractor should have notified minority and female organizations when employment opportunities were available and should have maintained records of the organization's response.

- The Contractor should have maintained a file of the names and addresses of each minority and female referred to it by any individual or organization and what action was taken with respect to each such referred individual, and if the individual was not employed by the Contractor, the reasons. If such individual was sent to the union hiring hall for referral and not referred back by the union or if referred, not employed by the Contractor, the file should have documented this and their reasons.
- c. The Contractor should have promptly notified the Department of Public Works, and the Division of Small Business Opportunity when the union or unions with which the Contractor has collective bargaining agreements did not refer to the contractor a minority or female sent by the contractor, or when the Contractor has other information that the union referral process has impeded efforts to meet its goals.
  - The Contractor should have disseminated its EEO policy within its organization by including it in any employee handbook or policy manual; by publicizing it in company newspapers and annual reports and by advertising such policy at reasonable intervals in union publications. The EEO policy should be further disseminated by conducting staff meetings to explain and discuss the policy; by posting of the policy; and by review of the policy with minority and female employees.
- e. The Contractor should have disseminated its EEO policy externally by informing and discussing it with all recruitment sources; by advertising in news media, specifically including minority and female news media; and by notifying and discussing it with all subcontractors.
- f. The Contractor should have made both specific and reasonably recurrent written and oral recruitment efforts. Such efforts should have been directed at minority and female organizations, schools with substantial minority and female enrollment, and minority and female recruitment and training organizations within the Contractor's recruitment area.
- g. The Contractor should have evidence available for inspection that all tests and other selection techniques used to select from among candidates for hire, transfer, promotion, training, or retention are being used in a manner that does not violate the OFCCP Testing Guidelines in 41 CFR Part 60-3.
- h. The Contractor should have made sure that seniority practices and job classifications do not have a discriminatory effect.
- i. The Contractor should have made certain that all facilities are not segregated by race.
- j. The Contractor should have continually monitored all personnel activities to ensure that its EEO policy was being carried out including the evaluation of minority and female employees for promotional opportunities on a quarterly basis and the encouragement of such employees to seek those opportunities.
- k. The Contractor should have solicited bids for subcontracts from available minority and female subcontractors engaged in the trades covered by these Bid Conditions, including circulation of minority and female contractor associations.
- NOTE: The Director and the Division of Small Business Opportunity will provide technical assistance on questions pertaining to minority and female recruitment sources, minority and female community organizations, and minority and female news media upon receipt of a request for assistance from a contractor.

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#### 3. NON - DISCRIMINATION:

In no event may a contractor utilize the goals and affirmative action steps required in such a manner as to cause or result in discrimination against any person on account of race, color, religion, sex, marital status, national origin, age, mental or physical handicap, political opinion or affiliation.

#### 4. **COMPLIANCE AND ENFORCEMENT:**

In all cases, the compliance of a contractor will be determined in accordance with its obligations under the terms of these Bid Conditions. All contractors performing or to perform work on projects subject to these Bid Conditions hereby agree to inform their subcontractors in writing of their respective obligations under the terms and requirements of these Bid Conditions, including the provisions relating to goals of minority and female employment and training.

#### B. CONTRACTORS SUBJECT TO THESE BID CONDITIONS:

In regard to these Bid Conditions, if the Contractor meets the goals set forth therein or can demonstrate that it has made every good faith effort to meet these goals, the Contractor shall be presumed to be in compliance with Article III, Division 2 of Chapter 28 of the Revised Municipal Code, the implementing regulations and its obligations under these Bid Conditions. In the event, no formal sanctions or proceedings leading toward sanctions shall be instituted unless the contracting or administering agency otherwise determines that the contractor is violating the Equal Opportunity Clause.

- 1. Where the Office of Contract Compliance finds that a contractor failed to comply with the requirements of Article III, Division 2 of Chapter 28 of the Revised Municipal Code or the implementing regulations and the obligations under these Bid Conditions, and so informs the Manager, the Manager shall take such action and impose such sanctions, which include suspension, termination, cancellation, and debarment, as may be appropriate under the Ordinance and its regulations. When the Manager proceeds with such formal action it has the burden of proving that the Contractor has not met the goals contained in these Bid Conditions. The Contractor's failure to meet its goals shall shift to it the requirement to come forward with evidence to show that it has met the good faith requirements of these Bid Conditions.
- 2. The pendency of such proceedings shall be taken into consideration by the Department of Public Works in determining whether such contractor can comply with the requirements of Article III, Division 2 of Chapter 28 of the Revised Municipal Code, and is therefore a "responsible prospective contractor".
- 3. The Division of Small Business Opportunity shall review the Contractor's employment practices during the performance of the contract. If the Division of Small Business Opportunity determines that the Contractor's Affirmative Action Plan is no longer an acceptable program, the Director shall notify the Manager.

#### C. OBLIGATIONS APPLICABLE TO CONTRACTORS:

It shall be no excuse that the union with which the Contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority or female employees. Discrimination in referral for employment, even if pursuant to provisions of a collective bargaining agreement, is prohibited by the National Labor Relations Act, as amended, Title VI of the Civil Rights Act of 1964, as amended, and Article III, Division 2 of Chapter 28 of the Revised Municipal Code. It is the policy of the Department of Public Works that contractors have a responsibility to provide equal employment opportunity, if they wish to participate in City and County of Denver contracts. To the extent they have delegated the responsibility for some of their employment practices to a labor organization and, as a result, are prevented from meeting their obligations pursuant to Article III, Division 2, Chapter 28 of the Revised Municipal Code, such Contractors cannot be considered to be in compliance with Article III, Division 2, Chapter 28 of the Revised Municipal Code, or its implementing rules and regulations.

#### **D. GENERAL REQUIREMENTS:**

Contractors are responsible for informing their subcontractors in writing regardless of tier, as to their respective obligations. Whenever a Contractor subcontracts a portion of work in any trade covered by

these Bid Conditions, it shall include these Bid Conditions in such subcontracts and each subcontractor shall be bound by these Bid Conditions to the full extent as if it were the prime contractor. The Contractor shall not, however, be held accountable for the failure of its subcontractors to fulfill their obligations under these Bid Conditions. However, the prime contractor shall give notice to the Director of any refusal or failure of any subcontractor to fulfill the obligations under these Bid Conditions. A subcontractor's failure to comply will be treated in the same manner as such failure by a prime contractor.

- 1. Contractors hereby agree to refrain from entering into any contract or contract modification subject to Article III, Division 2, Chapter 28 of the Revised Municipal Code with a contractor debarred from, or who is determined not to be a "responsive" bidder for the City and County of Denver contracts pursuant to the Ordinance.
- 2. The Contractor shall carry out such sanctions and penalties for violation of these Bid Conditions and the Equal Opportunity Clause including suspension, termination and cancellation of existing subcontracts and debarment from future contracts as may be ordered by the Manager pursuant to Article III, Division 2, Chapter 28 of the Revised Municipal Code and its implementing regulations.
- 3. Nothing herein is intended to relieve any contractor during the term of its contract from compliance with Article III, Division 2, Chapter 28 of the Revised Municipal Code, and the Equal Opportunity Clause of its contract with respect to matters not covered in these Bid Conditions.
- 4. Contractors must keep such records and file such reports relating to the provisions of these Bid Conditions as shall be required by the Office of Contract Compliance.
- 5. Requests for exemptions from these Bid Conditions must be made in writing, with justification, to the Manager of Public Works, 201 W. Colfax, Dept. 608, Denver, Colorado 80202, and shall be forwarded through and with the endorsement of the Director.

#### CITY AND COUNTY OF DENVER DEPARTMENT OF PUBLIC WORKS Engineering Division

#### CONTRACT NO. 201206436

#### DENVER POLICE DEPARTMENT COMMAND VEHICLE GARAGE

## CONTRACT

THIS CONTRACT AND AGREEMENT, made and entered into by and between the City and County of Denver, a municipal corporation of the State of Colorado, hereinafter referred to as the "City," party of the first part, and,

#### <u>Golden Triangle Construction, Inc.</u> <u>700 Weaver Park Rd.</u> <u>Longmont, CO 80501</u>

hereinafter referred to as the "Contractor," party of the second part,

WITNESSETH, Commencing on June 6, 2012, and for at least three (3) days the City advertised that sealed bids would be received for furnishing all labor, tools, supplies, equipment, materials, and everything necessary and required for the following:

#### CONTRACT NO. 201206436

#### DENVER POLICE DEPARTMENT COMMAND VEHICLE GARAGE

WHEREAS, bids pursuant to said advertisement have been received by the Manager of Public Works, who has recommended that a Contract for said work be made and entered into with the above named Contractor who was the lowest, responsive, qualified bidder therefore, and

WHEREAS, said Contractor is now willing and able to perform all of said work in accordance with said advertisement and its bid.

**NOW THEREFORE**, in consideration of the compensation to be paid the Contractor, the mutual agreements hereinafter contained, and subject to the terms hereinafter stated, it is mutually agreed as follows:

#### 1. CONTRACT DOCUMENTS

It is agreed by the parties hereto that the following list of documents, instruments, technical specifications, plans, drawings and other materials which are attached hereto and bound herewith, incorporated herein by reference or otherwise referenced in these documents constitute and shall be referred to either as the "Contract Documents" or the "Contract," and all of said documents, instruments, technical specifications, Plans, Drawings and other materials taken together as a whole constitute the Contract between the parties hereto, and they are as fully a part of this agreement as if they were set out verbatim and in full herein:

Advertisement of Notice of Invitation for Bids Instructions to Bidders Commitment to M/WBE Participation Article III, Divisions 1, 2, and 3 of Chapter 28, D.R.M.C. Bid Bond

Contract No. 201206436 DPD CVG

#### Addenda (as applicable)

Equal Employment Opportunity Provisions (Appendix A and Appendix F) Bid Form Contract Form General Contract Conditions Special Contract Conditions Performance and Payment Bond Notice to Apparent Low Bidder Notice to Proceed Contractor's Certification of Payment Form Final/Partial Lien Release Form Certificate of Contract Release Change Orders (as applicable) Federal Requirements (as applicable) Prevailing Wage Rate Schedule(s) Technical Specifications Contract Drawings Accepted Shop Drawings

#### 2. SCOPE OF WORK

The Contractor agrees to and shall furnish all labor, tools, supplies, equipment, materials and everything necessary for and required to do, perform and complete all of the Work described, drawn, set forth, shown and included in said Contract Documents.

#### 3. TERMS OF PERFORMANCE

The Contractor agrees to undertake the performance of the Work under this Contract within ten (10) days after being notified to commence work by issuance of a Notice to Proceed in substantially the form contained herein from the Manager and agrees to fully complete said Work within 270 (Two Hundred Seventy Days) consecutive calendar days from the effective date of said Notice, plus such extension or extensions of time as may be granted in accordance with the provisions of the General Contract Conditions and any applicable Special Contract Conditions.

#### 4. TERMS OF PAYMENT

The City agrees to pay the Contractor for the performance of all of the Work required under this Contract, and the Contractor agrees to accept as the Contractor's full and only compensation therefore, such sum or sums of money as may be proper in accordance with the price or prices set forth in the Contractor's Bid Form hereto attached and made a part hereof for Lump Sum Bid Amount plus Add Alternates No. 1 and No. 2, the total estimated cost thereof being <u>One Million One Hundred Eighty-Six Thousand One</u> <u>Hundred Dollars and No Cents (\$1,186,100.00</u>). Adjustments to said Contract Amount and payment of amounts due hereunder shall be made in accordance with the provisions of the General Contract Conditions and any applicable Special Contract Conditions.

#### 5. NO DISCRIMINATION IN EMPLOYMENT

In connection with the performance of the Work under this Contract, the Contractor agrees not to refuse to hire, discharge, promote or demote, or to discriminate in matters of compensation against any person otherwise qualified, solely because of race, color, religion, national origin, gender, age, military status, sexual orientation, marital status, or physical or mental disability; and the Contractor further agrees to insert the foregoing provision in all subcontracts hereunder.

#### 6. **COMPLIANCE WITH M/WBE REQUIREMENT**

This Contract is subject to all applicable provisions of Divisions 1 and 3 of Article III, of Chapter 28, Denver Revised Municipal Code (D.R.M.C.), designated as Sections 28-31 – 28-36 and 28-52 – 28-90 D.R.M.C. and referred to in this Contract as the "M/WBE Ordinance". Without limiting the general applicability of the foregoing, the Contractor acknowledges its continuing duty, pursuant to Sections 28-72, 28-73 and 28-75 of the D.R.M.C., to maintain throughout the duration of this Contract, compliance with the level of minority and Woman business enterprise participation, upon which the City approved the award of

this Contract to the Contractor and the Contractor further acknowledges that failure to maintain such participation commitments or otherwise comply with the requirements of the M/WBE Ordinance shall subject the Contractor to sanctions in accordance with Section 28-77 of the D.R.M.C. Nothing contained in this provision or in the M/WBE Ordinance shall negate the City's right to prior approval of subcontractors, or substitutes therefore, under this Contract

#### 7. WAGE RATE REQUIREMENTS

In performance of all Work hereunder, the Contractor agrees to comply with and be bound by all requirements and conditions of the City's Payment of Prevailing Wages Ordinance, Sections 20-76 through 20-79, D.R.M.C. and any determinations made by the City pursuant thereto.

#### 8. APPLICABILITY OF LAWS

The Agreement between the Contractor and the City shall be deemed to have been made in the City and County of Denver, State of Colorado and shall be subject to, governed by, and interpreted and construed by or in accordance with the laws of the State of Colorado and the Charter, Revised Municipal Code, Rules, Regulations, Executive Orders and fiscal rules of the City. As such, the Contractor shall at all times comply with the provisions of the Charter, Revised Municipal Code, Rules, Regulations, Executive Orders and fiscal rules of Colorado and Federal Laws, Rules and Regulations, which in any manner limit, control or apply to the actions or operations of the Contractor, any subcontractors, employees, agents or servants of the Contractor engaged in the Work or affecting the materials and equipment used in the performance of the Work, as the same may be, from time to time, promulgated, revised or amended. The Charter and Revised Municipal Code of the City and County of Denver, as the same may be amended from time to time, are hereby expressly incorporated into this Agreement as if fully set out herein by this reference.

#### 9. **APPROPRIATION**

The amount of money, which has been appropriated and encumbered for the purpose of this contract, to date, is equal to or in excess of the Contract Amount. The Manager, upon reasonable written request, will advise the Contractor in writing of the total amount of appropriated and encumbered funds, which remain available for payment for all Work under the Contract.

The issuance of any change order or other form or order or directive by the City which would cause the aggregate payable under the contract to exceed the amount appropriated for the contract is expressly prohibited. In no event shall the issuance of any change order or other form of order or directive by the City be considered valid or binding if it requires additional compensable work to be performed, which work will cause the aggregate amount available under the Contract to exceed the amount appropriated and encumbered for this Contract, unless and until such time as the Contractor has been advised in writing by the Manager that a lawful appropriation, sufficient to cover the entire cost of such additional work, has been made.

It shall be the responsibility of the Contractor to verify that the amounts already appropriated for this Contract are sufficient to cover the entire cost of such work, and any work undertaken or performed in excess of the amount appropriated is undertaken or performed in violation of the terms of this contract, without the proper authorization for such work, and at the Contractor's own risk.

#### 10. APPROVALS

In the event this Contract calls for the payment by the City of five hundred thousand dollars (\$500,000.00) or more, approval by the Board of Councilmen of the City and County of Denver, acting by ordinance, in accordance with Section 3.2.6 of the Charter of the City and County of Denver, is and shall be an express condition precedent to the lawful and binding execution and effect and performance of this contract.

#### 11. ASSIGNMENT

The Contractor shall not assign any of its rights, benefits, obligations or duties under this Contract except upon the prior written consent and approval of the Manager to such assignment.

#### 12. DISPUTES RESOLUTION PROCESS

It is the express intention of the parties to this Contract that all disputes of any nature whatsoever regarding the Contract including, but not limited to, any claims for compensation or damages arising out of breach or default under this Contract, shall be resolved by administrative hearing pursuant to the provisions of Section 56-106, D.R.M.C., or, as applicable, Section 28-33 D.R.M.C. for Minority and Woman Business Enterprise disputes. The Contractor expressly agrees that this dispute resolution process is the only dispute resolution mechanism that will be recognized by the parties for any claims put forward by the Contractor, notwithstanding any other claimed theory of entitlement on the part of the Contractor or its subcontractors or suppliers.

#### 13. CONTRACT BINDING

It is agreed that this Contract shall be binding on and inure to the benefit of the parties hereto, their heirs, executors, administrators, assigns and successors.

#### 14. PARAGRAPH HEADINGS

The captions and headings set forth herein are for convenience of reference only and shall not be construed so as to define or limit the terms and provisions hereof.

#### 15. SEVERABILITY

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It is understood and agreed by the parties hereto that, if any part, term, or provision of this Contract, except for the provisions of this Contract requiring prior appropriation and limiting the total amount to be paid by the City, is by the courts held to be illegal or in conflict with any law of the State of Colorado, the validity of the remaining portions or provisions shall not be affected, and the rights and obligations of the parties shall be construed and enforced as if the Contract did not contain the particular part, term or provision held to be invalid.

#### 16. ELECTRONIC SIGNATURES AND ELECTRONIC RECORDS:

Contractor consents to the use of electronic signatures by the City. The Agreement, and any other documents requiring a signature hereunder, may be signed electronically by the City in the manner specified by the City. The Parties agree not to deny the legal effect or enforceability of the Agreement solely because it is in electronic form or because an electronic record was used in its formation. The Parties agree not to object to the admissibility of the Agreement in the form of an electronic record, or a paper copy of an electronic document, or a paper copy of a document bearing an electronic signature, on the ground that it is an electronic record or electronic signature or that it is not in its original form or is not an original.

**Contract Control Number:** 

IN WITNESS WHEREOF, the parties have set their hands and affixed their seals at Denver, Colorado as of

| SEAL                 | CITY AND COUNTY OF DENVER     |
|----------------------|-------------------------------|
| ATTEST:              | By                            |
|                      |                               |
| APPROVED AS TO FORM: | REGISTERED AND COUNTERSIGNED: |
|                      | By                            |
| By                   |                               |

By\_\_\_\_\_



IN WITNESS WHEREOF, the parties have executed this agreement and affixed their seals at Denver, Colorado as of the day first above written.

Contract Control Number: 201206436

Vendor Name:

1

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Golden Triangle Construction By:

| Name: | Brian R. Laartz |  |
|-------|-----------------|--|
|       | (please print)  |  |

Title: President (please print)

**ATTEST:** [if required]

By:

Name: <u>Sayaros Mohamed</u> (please print)

Title: Assistant Secretary
(please print)

# CITY AND COUNTY OF DENVER DEPARTMENT OF PUBLIC WORKS

# **General Contract Conditions**

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#### CITY AND COUNTY OF DENVER DEPARTMENT OF PUBLIC WORKS Engineering Division

#### SPECIAL CONTRACT CONDITIONS

#### SC-1 CONSTRUCTION SPECIFICATIONS

Except as amended herein or in the attached Technical Specifications, all Work performed under the terms of this Contract shall be governed by the applicable provisions of the following latest editions:

#### City and County of Denver:

Standard Specifications for Construction, GENERAL CONTRACT CONDITIONS, (The Index for which is bound herein and commonly referred to as the "Orange Book") (1999 Edition)

Transportation Standards and Details for the Engineering Division

City and County of Denver Traffic Standard Drawings

Wastewater Management Division – Standard Detail Drawings

- Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications

#### Colorado Department of Transportation:

Standard Specifications for Road and Bridge Construction (Sections 200 through 700 of the 2011 Edition)

#### Federal Highway Administration:

Manual on Uniform Traffic Control Devices for Streets & Highways (MUTCD)

#### Building & Fire Codes:

Building Code of the City and County of Denver (International Building Code 2006 Series, City and County of Denver Amendments 2006)

National Fire Protection Association Standards (As referenced in the Building Code of the City and County of Denver)

The aforementioned City and County of Denver documents are available for review at the Capital Projects Management Office, 201 W. Colfax Ave., Dept. 506, (5<sup>th</sup> floor), Denver, CO 80202. The *Standard Specifications for Construction*, *GENERAL CONTRACT CONDITIONS* is available for purchase at the Cashier, 2<sup>nd</sup> floor at 201 W. Colfax Ave., Denver, Colorado 80202. *Transportation Standards and Details for the Engineering Division* and the Wastewater Management Division – *Standard Detail Drawings*, are available at http://www.denvergov.org.

The "Colorado Department of Transportation Standard Specifications for Road and Bridge Construction" is available for review on CDOT's website at <u>http://www.coloradodot.info/</u> and can be purchased from the Colorado Department of Transportation.

The Manual on Uniform Traffic Control Devices for Streets & Highways is available for review at the Federal Highway Administration Website at: <u>www.fhwa.dot.gov</u>, The FHWA website also contains purchasing information.

#### SC-2 CONSTRUCTION DOCUMENTS

The construction documents consist of Plans, Technical Specifications and, if applicable, Drawings as identified in the Index for Contract Drawings, the Index for Technical Specifications and any additional Plans attached hereto.

#### SC-3 DEPUTY MANAGER / CITY ENGINEER

General condition 109 DEPUTY MANAGER is hereby deleted in its entirety and replaced with the following:

The "Deputy Manager" means the official who reports directly to the Manager and exercises supervisory responsibility in the City agency defined in Title 2 herein that is responsible for the Project. The Manager hereby designates the City Engineer as the Deputy Manager for purposes of this Contract. The City Engineer shall have responsibility for this Project and shall undertake all duties, responsibilities, rights and authority, including specific actions and decisions, delegated to the Deputy Manager under the various terms and conditions of this Contract.

#### SC-4 ENGINEERING DIVISION / CITY ENGINEER

General Condition 206, TRANSPORTATION DIVISION, is hereby deleted in its entirety and replaced with the following:

The Engineering Division is a unit of the Department of Public Works and is supervised by the City Engineer, who is subordinate to the Manager of Public Works. This Division is responsible for the planning, design, construction, operation and maintenance of all of the City's transportation facilities and the planning, design and construction of all of the City's wastewater facilities, except for the City's Municipal Airport System. All other references to the Transportation Division or the Deputy Manager of Public Works for Transportation are deleted and replaced with references to the Engineering Division and City Engineer, respectively.

#### SC-5 WASTEWATER MANAGEMENT DIVISION

General Condition Section 208, WASTEWATER MANAGEMENT DIVISION, is hereby deleted in its entirety and replaced with the following:

The Wastewater Management Division is a unit of the Department of Public Works and is supervised by the Deputy Manager of Public Works for Wastewater Management, who is subordinate to the Manager of Public Works. This Division is responsible for the operation and maintenance of the City's wastewater facilities.

#### SC-6 CITY DELEGATION OF AUTHORITY

With reference to General Contract Condition 109, DEPUTY MANAGER, General Contract Condition 206, ENGINEERING DIVISION and General Contract Condition 214, CITY'S CONTRACT ADMINISTRATION LINE OF AUTHORITY, the Manager hereby designates the City Engineer as the City official responsible for those certain actions and decisions designated as the responsibility of the Deputy Manager under the General Conditions and delegates to the City Engineer the authority necessary to undertake those responsibilities under this Contract. The Director shall have supervisory responsibility over the Project Manager. Additionally, Contractor questions concerning the Plans and Technical Specifications shall be directed to:

#### Denver Department of Public Works / Engineering Division,

Project Manager City Project Manager Dick Gillet <u>Telephone</u>

(720) 913-1676

#### SC-7 LIQUIDATED DAMAGES

Should the Contractor fail to complete all Work within the Contract Time allocated under the Contract Form at Paragraph 3, TERMS OF PERFORMANCE, the Contractor shall become liable to the City and County of Denver for liquidated damages, and not as a penalty, at the rate of \$1,000.00 for each Day that the Contractor exceeds the time limits herein specified, all in accordance with provisions of General Contract Condition 602, LIQUIDATED DAMAGES; ADMINISTRATIVE COSTS; ACTUAL DAMAGES.

Representative hourly rates for the City administrative costs described in General Contract Condition 602.2 shall be as follows for this Project:

| Project Manager         |  |
|-------------------------|--|
| Project Engineer        |  |
| Inspector               |  |
| Surveying, if necessary |  |

\$69 per hour\$63 per hour\$49 per hour\$100 per hour

#### SC-8 SUBCONTRACTS

In accordance with General Contract Condition 501, SUBCONTRACTS, no limit shall apply to that percentage of the Work, which may be sublet providing that the subcontractors receive prior approval in accordance with General Contract Condition 502, SUBCONTRACTOR ACCEPTANCE.

#### SC-9 PAYMENTS TO CONTRACTORS

In accordance with General Contract Condition 902, PAYMENT PROCEDURE, the party(ies) responsible for review of all Pay Applications shall be:

| Agency/Firm                       | <u>Name</u>     | <u>Telephone</u> |
|-----------------------------------|-----------------|------------------|
| Public Works/Engineering Division | Michael Sheehan | (720) 865-2664   |

In accordance with General Contract Condition 906, APPLICATIONS FOR PAYMENT, each Application submitted shall include the following:

- 1. The estimate of Work completed shall be based on the approved schedule of values or unit prices, as applicable, and the percent of the Work complete.
- 2. Each Application for Payment shall include each and every independent subcontractor's payroll information including pay dates and pay amounts.
- 3. The Contractor shall also submit to the Auditor and other appropriate officials of the City in a timely fashion, information required by General Contract Condition 1004, REPORTING WAGES PAID.

In accordance with General Contract condition 907, RELEASES AND CONTRACTORS CERTIFICATION OF PAYMENT, Applications for Payment must be accompanied by completed Partial or Final Claim Release Form, as appropriate, from EACH subcontractor and supplier, <u>AND</u> the Contractors' Certification of Payment Form. The forms, Final/Partial Release and Certificate of Payment (Subcontractor/Supplier) and the Contractor's Certification of Payment, both of which must be used are as follows:

#### DEPARTMENT OF PUBLIC WORKS Engineering Division

#### FINAL/PARTIAL RELEASE AND CERTIFICATE OF PAYMENT (SUBCONTRACTOR/SUPPLIER)

|                                  | Date:                     | , 20     |
|----------------------------------|---------------------------|----------|
| (PROJECT NO. and NAME)           |                           |          |
|                                  | Subcontract #:            |          |
| (NAME OF CONTRACTOR)             |                           |          |
|                                  | Subcontract Value: \$     | <u> </u> |
|                                  | Last Progress Payment: \$ | · · · ·  |
| (NAME OF SUBCONTRACTOR/SUPPLIER) | Date:                     | ·        |
| Check Applicable Box:            | Total Paid to Date: \$    | <u> </u> |
| [] MBE [] WBE                    | Date of Last Work:        | <u> </u> |
| Check Applicable Box:            | Total Paid to Date: \$    |          |

The Undersigned hereby certifies that all costs, charges or expenses incurred by the undersigned or on behalf of the undersigned for any work, labor or services performed and for any materials, supplies or equipment provided on the above referenced Project or used in connection with the above referenced Subcontract (the "Work Effort") have been duly paid in full.

The Undersigned further certifies that each of the undersigned's subcontractors and suppliers that incurred or caused to be incurred, on their behalf, costs, charges or expenses in connection with the undersigned's Work Effort on the above referenced Project have been duly paid in full.

In consideration of \$\_\_\_\_\_\_\_ representing the Last Progress Payment referenced above and in further consideration of the Total Paid to Date, also referenced above, and other good and valuable consideration received and accepted by the undersigned this \_\_\_\_\_\_ day of \_\_\_\_\_\_, 20\_\_\_, the Undersigned hereby releases and discharges the City and County of Denver (the "City"), the above referenced City Project, the City's premises and property and the above referenced Contractor from all claims, liens, rights, liabilities, demands and obligations, whether known or unknown, of every nature arising out of or in connection with the performance of the work effort.

As additional consideration for the payments referenced above, the undersigned agrees to defend, indemnify and save and hold harmless the City, its officers, employees, agents and assigns and the above-referenced Contractor from and against all costs, losses, damages, causes of action, judgments under the subcontract and expenses arising out of or in connection with any claim or claims against the City or the Contractor which arise out of the Undersigned's performance of the Work Effort and which may be asserted by the Undersigned or any of its suppliers or subcontractors of any tier or any of their representatives, officers, agents, or employees.

It is acknowledged that this release is for the benefit of and may be relied upon by the City and the referenced Contractor.

The foregoing shall not relieve the undersigned of any obligation under the provisions of the Undersigned's subcontract, as the subcontract may have been amended, which by their nature survive completion of the Undersigned's work effort including, without limitation, warranties, guarantees, insurance requirements and indemnities.

| STATE OF COLORADO ) ss.<br>CITY OF ) |                         |  |
|--------------------------------------|-------------------------|--|
| ,                                    | (Name of Subcontractor) |  |
| Signed and sworn before me this      |                         |  |
| day of, 20                           | By:                     |  |
| <u> </u>                             |                         |  |
| Notary Public/Commissioner of Oaths  | Title:                  |  |
| My Commission Expires                |                         |  |
|                                      |                         |  |

|                                                                                |                                         |                              |                          |             |                           | •            |                          |                                    |                         |                    |  |  |  |  |  |
|--------------------------------------------------------------------------------|-----------------------------------------|------------------------------|--------------------------|-------------|---------------------------|--------------|--------------------------|------------------------------------|-------------------------|--------------------|--|--|--|--|--|
|                                                                                |                                         |                              |                          | A-4         |                           |              |                          |                                    | Office of Economic C    |                    |  |  |  |  |  |
|                                                                                |                                         |                              |                          | City        | y and County of           | Denve        | <u> </u>                 | Compliance Unit                    |                         |                    |  |  |  |  |  |
|                                                                                |                                         |                              | <b>5</b> .2              |             |                           |              | 201 W. Collax Avi        |                                    |                         |                    |  |  |  |  |  |
|                                                                                |                                         | <u> </u>                     | DIV                      | ISION       | of Small Business         | Орры         | tunity                   |                                    |                         | CO 8020            |  |  |  |  |  |
|                                                                                |                                         |                              |                          | <b>~</b>    |                           |              | n                        |                                    |                         |                    |  |  |  |  |  |
|                                                                                |                                         | Comra                        | ictor's/                 | Jons        | ultant's Certifica        |              | Fax: 7                   | 20.913.180                         |                         |                    |  |  |  |  |  |
| Prime Contractor or Consultant                                                 |                                         |                              |                          | Phone       |                           |              | Project Manager.         |                                    |                         |                    |  |  |  |  |  |
| E DEEN WAID AVIA IN VERIALIETE                                                 |                                         | İ                            |                          | a prestate. |                           |              | e toge se ananoaget.     |                                    |                         |                    |  |  |  |  |  |
| Pay Application #:                                                             |                                         | Pay Period:                  |                          |             |                           |              | Amount Requested: \$     |                                    |                         |                    |  |  |  |  |  |
| Project #:                                                                     |                                         | Project Nam                  | e:                       |             |                           |              |                          |                                    |                         |                    |  |  |  |  |  |
|                                                                                |                                         |                              |                          |             | ii ii                     |              |                          |                                    |                         |                    |  |  |  |  |  |
| Current Completion Date:                                                       |                                         | Percent Con                  | ipiete:                  |             |                           |              | Prepared By:             |                                    |                         |                    |  |  |  |  |  |
| (I) - Original Contract Amount: \$                                             |                                         |                              |                          |             |                           | (N) - Curn   | ent Contract Amount: \$  |                                    |                         |                    |  |  |  |  |  |
|                                                                                |                                         | A                            |                          | 8           | C                         | D            | E                        | F.                                 | 9                       | н                  |  |  |  |  |  |
|                                                                                | MW/S/<br>DBE/                           | Original                     | Contract                 | % Bid       | Current Contract Amount   | %<br>Revised | Requested Amount of this | Amount Paid on the<br>Previous Pay | Net Pald                | Paid %<br>Achieved |  |  |  |  |  |
| Prime/Subcontractor/Supplier Name                                              | NON                                     | Amo                          |                          | (A)         | Including Amendments      | (СЛІ)        | Pay Application          | Application #                      | To Date                 | (G/II)             |  |  |  |  |  |
|                                                                                |                                         |                              |                          | [           |                           |              |                          |                                    |                         |                    |  |  |  |  |  |
|                                                                                | L                                       |                              |                          |             |                           |              |                          |                                    |                         |                    |  |  |  |  |  |
| ,                                                                              |                                         | ļ,                           |                          |             |                           |              |                          |                                    |                         | <b>i</b>           |  |  |  |  |  |
|                                                                                |                                         |                              |                          |             |                           |              |                          |                                    |                         |                    |  |  |  |  |  |
| · · · · ·                                                                      |                                         |                              |                          |             |                           |              |                          |                                    |                         |                    |  |  |  |  |  |
|                                                                                |                                         |                              |                          |             |                           |              |                          |                                    |                         |                    |  |  |  |  |  |
|                                                                                |                                         |                              |                          |             |                           |              |                          |                                    |                         |                    |  |  |  |  |  |
|                                                                                |                                         |                              |                          |             |                           |              |                          |                                    |                         | L                  |  |  |  |  |  |
|                                                                                |                                         |                              |                          |             |                           |              |                          |                                    |                         |                    |  |  |  |  |  |
|                                                                                |                                         |                              | ·                        |             |                           |              |                          |                                    |                         |                    |  |  |  |  |  |
| · ··· ··· ··· ··· ··· ··· ··· ··· ···                                          |                                         |                              |                          | · · ·       |                           |              |                          |                                    |                         | <u> </u>           |  |  |  |  |  |
|                                                                                |                                         |                              |                          |             |                           |              |                          |                                    |                         |                    |  |  |  |  |  |
| · · · · ·                                                                      |                                         |                              |                          |             |                           |              |                          |                                    |                         | <b> </b>           |  |  |  |  |  |
|                                                                                |                                         |                              |                          |             |                           |              |                          |                                    | · · · ·                 |                    |  |  |  |  |  |
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|                                                                                |                                         |                              |                          |             |                           |              |                          |                                    |                         |                    |  |  |  |  |  |
| Totals                                                                         |                                         |                              |                          |             |                           |              |                          |                                    |                         |                    |  |  |  |  |  |
| The undersigned certifies that the ink<br>and listed herein. Please use an add | ermation s<br>tinest for                | n if more sm                 | his doeum<br>toe is need | ent is tr   | ue, coourate and that the | payment      | s shown have been made   | to all subcontractors o            | nd suppliers used on it | vis project        |  |  |  |  |  |
| men mayor ristant, raphan un di dugi                                           | 1997 1997 1997 1997 1997 1997 1997 1997 | к, а шығ <i>а</i> <b>а</b> р |                          |             |                           |              |                          |                                    | ·                       | . <u> </u>         |  |  |  |  |  |
| Prepared By (Signature):                                                       | Prepared By (Stonature):                |                              |                          |             |                           |              |                          |                                    | Data:                   |                    |  |  |  |  |  |
|                                                                                |                                         |                              |                          |             | Page                      | of           |                          |                                    |                         |                    |  |  |  |  |  |
| COMP-FRM-027 rev 022311                                                        |                                         |                              |                          |             |                           |              |                          |                                    |                         |                    |  |  |  |  |  |

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### Instructions for Completing the Contractor/Consultant Certification of Payment Form

Office of Economic Development Division of Small Business Opportunity Compliance Unit 201 W. Colfax Ave., Dept. 907 Denver, CO 80202 Phone: 720-913-1999 Fax: 720-913-1803 dsbo@denvergov.org

Note: The attached Contractor/Consultant Certification of Payment form must be completed by the Contractor/ Subconsultant and all subcontractors/subconsultant or suppliers used on the project at any tier and submitted with each pay application. The Contractor/Consultant is responsible for the accuracy of all information provided and is required to have each subcontractor/subconsultant or supplier fill out the appropriate forms. Please be sure to complete all information requested at the top of the form, including the name of the person who prepared this form.

If you reproduce this form, you must continue to list each of the originally listed firms, as well as any additional firms used during the performance period of the contract.

If you have any questions, please call the Compliance Unit of DSBO at 720.913.1999.

Instructions for Completing the Contractor/Consultant Certification of Payment Form, per Column Contractor/Subcontractor or Subconsultant/Supplier Name: In the space provided, list all subcontractors/ subconsultants and suppliers used on the project. For all M/W/S/DBEs use the exact name listed in the **DSBO Directory.** M/W/S/DBE/NON: For each name listed, indicate whether the entity is a certified M/W/S/DBE. Provide the contract amount, as listed at bid time, for the Contractor/Consultant and each Column A: subcontractor/subconsultant or supplier. Column B: Provide the percentage portion of each listed subcontractor/subconsultant or supplier contract amount (Column A) compared to the total original contract amount in (I). Provide the original contract amount (Column A) for each subcontractor/subconsultant or supplier plus any <u>Column C:</u> awarded alternate and/or change order amounts applicable. If an alternate/change order does not apply to the listed firm, re-enter the original contract amount (Column A). Provide the percent portion of each listed subcontractor/subconsultant or supplier contract amount Column D: (Column C) compare to the current total contract amount in (II). Provide the amount requested for work performed or materials supplied by each listed Column E: subcontractor/subconsultant or supplier for this pay application. The sum of the items in this column should equal the estimated amount requested for this pay application. Provide the amount paid to each subcontractor/subconsultant or supplier on the previous pay Column F: application. Enter the previous pay application number in the column heading. The sum of the items listed in this column should equal the warrant amount paid to the Contractor/Consultant on the previous pay application. The amounts paid to the subcontractor/subcontractor or suppliers should be the actual amount of each check issued. Provide the net paid to date for the Contractor/Subconsultant and each listed subcontractor/subconsultant Column G: or supplier. Provide the percent portion of the net paid to date (Column G) for the Contractor/Subconsultant and each Column H: listed subcontractor/subconsultant or supplier of the current total contract amount in (II).

COMP-REF-031

Rev 032211 IG

#### SC-10 RESERVED

#### SC-11 MINORITY BUSINESS ENTERPRISES AND WOMEN BUSINESS ENTERPRISES

In a March 7, 2000 opinion and order of the United States District Court for the District of Colorado, all terms, provisions and requirements relating to the implementation and enforcement of Article III, Divisions I and III, of Chapter 28 of the Denver Revised Municipal Code, (the "MBE/WBE Requirements") in effect as of the adoption of the General Conditions in 1999 were held invalid, and they are hereby deleted. All such terms, provisions and requirements in the General Conditions are hereby replaced with references to the following later-enacted ordinances:

- Denver Revised Municipal Code, Chapter 28 Article III, Division 1 (Sections 28-31 to 28-36) (establishment of Small Business Opportunity Division, "DSBO");
- Denver Revised Municipal Code, Chapter 28 Article III, Division 3 (Sections 28-52 to 28-83) (the "MBE/WBE Requirements"); and
- Denver Revised Municipal Code, Chapter 28, Article VII (Sections 28-201 to 28-234) (the "SBE Requirements").

Such revised provisions of the General Conditions include, without limitation, General Contract Condition 210.

#### SC-12 CONTRACT FORMS

In accordance with the terms and conditions of the Contract Documents, the City requires the use of certain form documents in complying with or satisfying various obligations, notifications and conditions in contracting with the City or performing Work hereunder. These form documents are referenced by title throughout the Contract Documents for mandatory use as directed. The following are the forms that shall be detached and utilized in accordance with the Contract Documents:

- 1. Performance and Payment Bond
- 2. Performance and Payment Bond Surety Authorization Letter (Sample)

The following are forms that will be issued by the City during construction:

- 1. Notice to Apparent Low Bidder (Sample)
- 2. Notice to Proceed (Sample)
- 3. Certificate of Contract Release (Sample)

#### SC-13 CONSTRUCTION INSPECTION BY THE CITY

General Condition 1701, CONSTRUCTION INPSECTION BY THE CITY, is modified as follows:

1701 Persons who are employees of the City or who are under contract to the City or the City as lessee will be assigned to inspect and test the Work. These persons may perform any tests and observe the Work to determine whether or not designs, materials used, manufacturing and construction processes and methods applied, and equipment installed satisfy the requirements of the drawings and specifications, accepted Shop Drawings, Product Data and Samples, and the General Contractor's warranties and guarantees. The General Contractor shall permit these inspectors unlimited access to the Work and provide means of safe access to the Work, which cost shall be included as a Cost of the Work without any increase to the Guaranteed Maximum Price. In addition, General Contractor shall provide whatever access and means of access are needed to off-site facilities used to store or manufacture materials and equipment to be incorporated into the Work and shall respond to any other reasonable request to further the inspector's ability to observe or complete any tests. Such inspections shall not relieve the General Contractor of any of its quality control responsibilities or any other obligations under the Contract. All inspections and all tests conducted by the City are for the convenience and benefit of the City. These inspections and tests do not constitute acceptance of the materials or Work tested or inspected, and the City may reject or accept any Work or materials at any time prior to the inspections pursuant to G.C. 2002, whether or not previous inspections or tests were conducted by the inspector or a City representative.

.2 The Building Inspection Division will perform building code compliance inspections for structures designed for human occupancy. It is the General Contractor's responsibility to schedule and obtain these inspections. If a code compliance inspection results in identification of a condition which will be at variance to the Contract Documents, the General Contractor shall immediately notify the Project Manager and confirm such notification with formal correspondence no later than forty-eight (48) hours after the occurrence.

.3 When any unit of government or political subdivision, utility or railroad corporation is to pay a portion of the cost of the Work, its respective representatives shall have the right to inspect the Work. This inspection shall not

make any unit of government or political subdivision, utility or railroad corporation a party to the Contract, and shall not interfere with the rights of either party.

#### SC-14 DISPOSAL OF NON-HAZARDOUS WASTE AT DADS

In accordance with the Landfill Agreement made between the City and Waste Management of Colorado, Inc., bidders will be required to haul dedicated loads (non-hazardous entire loads of waste) to the Denver-Arapahoe Disposal Site ("DADS") for disposal. DADS is located at Highway 30 and Hampden Avenue in Arapahoe County, Colorado. The City will pay all fees associated with such disposal but the bidder shall be responsible for the costs of transporting the loads. Non-hazardous waste is defined as those substances and materials not defined or classified as hazardous by the Colorado Hazardous Waste Commission pursuant to C.R.S. §25-15-101(6), as amended from time to time, and includes construction debris, soil and asbestos. Bidders shall not use Gun Club Road between I-70 and Mississippi Avenue as a means of access to DADS.

#### SC-15 PROHIBITION ON USE OF CCA-TREATED WOOD PRODUCTS

The use of any wood products pressure-treated with chromated copper arsenate (CCA) is prohibited. Examples of CCA-treated wood products include wood used in play structures, decks, picnic tables, landscaping timbers, fencing, patios, walkways and boardwalks.

#### SC-16 WAIVER OF: PART 8 OF ARTICLE 20 OF TITLE 13, COLORADO REVISED STATUTES.

The Contractor specifically waives all the provisions of Part 8 of Article 20 of Title 13, Colorado Revised Statutes regarding defects in the Work under this Construction Contract.

#### SC-17 DEBARRED SUBCONTRACTORS PROHIBITED

The Contractor is prohibited from hiring any subcontractor currently debarred by the City in accordance with section 20-77 of the Denver Revised Municipal Code.

#### SC-18 ATTORNEY'S FEES

Colorado Revised Statute 38-26-107 requires that in the event any person or company files a verified statement of amounts due and unpaid in connection with a claim for labor and materials supplied on this project, the City shall withhold from payments to the Contractor sufficient funds to insure the payment of any such claims. Should the City and County of Denver be made a party to any lawsuit to enforce such unpaid claims or any lawsuit arising out of or relating to such withheld funds, the Contractor agrees to pay to the City its costs and a reasonable attorney's fee which cost shall be included as a Cost of the Work.

Because the City Attorney Staff does not bill the City for legal services on an hourly basis, the Contractor agrees a reasonable fee shall be computed at the rate of one hundred dollars per hour of City Attorney time.

#### SC 19: INSURANCE

General Condition 1601 is hereby deleted in its entirety and replaced with the following:

Contractor agrees to secure, at or before the time of execution of this Agreement, **General Conditions:** (1) the following insurance covering all operations, goods or services provided pursuant to this Agreement. Contractor shall keep the required insurance coverage in force at all times during the term of the Agreement, or any extension thereof, during any warranty period, and for three (3) years after termination of the Agreement. The required insurance shall be underwritten by an insurer licensed or authorized to do business in Colorado and rated by A.M. Best Company as "A-"VIII or better. Each policy shall contain a valid provision or endorsement requiring notification to the City in the event any of the required policies be canceled or non-renewed before the expiration date thereof. Such written notice shall be sent to the parties identified in the Notices section of this Agreement. Such notice shall reference the City contract number listed on the signature page of this Agreement. Said notice shall be sent thirty (30) days prior to such cancellation or non-renewal unless due to non-payment of premiums for which notice shall be sent ten (10) days prior. If such written notice is unavailable from the insurer, contractor shall provide written notice of cancellation, non-renewal and any reduction in coverage to the parties identified in the Notices section by certified mail, return receipt requested within three (3) business days of such notice by its insurer(s) and referencing the City's contract number. If any policy is in excess of a deductible or self-insured retention, the City must be notified by the Contractor, Contractor shall be responsible for the payment of any deductible or self-insured retention. The insurance coverages specified in this Agreement are the minimum requirements, and these requirements do not lessen or limit the liability of the Contractor. The Contractor shall maintain, at its own expense, any additional kinds or amounts of insurance that it may deem necessary to cover its obligations and liabilities under this Agreement.

(2) <u>Proof of Insurance</u>: Contractor shall provide a copy of this Agreement to its insurance agent or broker. Contractor may not commence services or work relating to the Agreement prior to placement of coverage. Contractor certifies that the certificate of insurance attached as part of the Contract Documents, preferably an ACORD certificate, complies with all insurance requirements of this Agreement. The City requests that the City's contract number be referenced on the Certificate. The City's acceptance of a certificate of insurance or other proof of insurance that does not comply with all insurance requirements set forth in this Agreement shall not act as a waiver of Contractor's breach of this Agreement or of any of the City's rights or remedies under this Agreement. The City's Risk Management Office may require additional proof of insurance, including but not limited to policies and endorsements.

(3) <u>Additional Insureds</u>: For Commercial General Liability and Auto Liability, Contractor and subcontractor's insurer(s) shall name the City and County of Denver, its elected and appointed officials, employees and volunteers as additional insured.

(4) <u>Waiver of Subrogation</u>: For all coverages, Contractor's insurer shall waive subrogation rights against the City.

(5) <u>Subcontractors and Subconsultants:</u> All subcontractors and subconsultants (including independent contractors, suppliers or other entities providing goods or services required by this Agreement) shall be subject to all of the requirements herein and shall procure and maintain the same coverages required of the Contractor. Contractor shall include all such subcontractors as additional insured under its policies (with the exception of Workers' Compensation) or shall ensure that all such subcontractors and subconsultants maintain the required coverages. Contractor agrees to provide proof of insurance for all such subcontractors and subconsultants upon request by the City.

(6) <u>Workers' Compensation/Employer's Liability Insurance:</u> Contractor shall maintain the coverage as required by statute for each work location and shall maintain Employer's Liability insurance with limits of \$100,000 per occurrence for each bodily injury claim, \$100,000 per occurrence for each bodily injury caused by disease claim, and \$500,000 aggregate for all bodily injuries caused by disease claims. Contractor expressly represents to the City, as a material representation upon which the City is relying in entering into this Agreement, that none of the Contractor's officers or employees who may be eligible under any statute or law to reject Workers' Compensation Insurance shall effect such rejection during any part of the term of this Agreement, and that any such rejections previously effected, have been revoked as of the date Contractor executes this Agreement.

(7) <u>Commercial General Liability</u>: Contractor shall maintain a Commercial General Liability insurance policy with limits of \$1,000,000 for each occurrence, \$1,000,000 for each personal and advertising injury claim, \$2,000,000 products and completed operations aggregate, and \$2,000,000 policy aggregate.

(8) Business Automobile Liability: Contractor shall maintain Business Automobile

Liability with limits of \$1,000,000 combined single limit applicable to all owned, hired and non-owned vehicles used in performing services under this Agreement.

(9) <u>Builders' Risk or Installation Floater</u>: Contractor shall maintain limits equal to the completed value of the project. Coverage shall be written on an all risk, replacement cost basis including coverage for soft costs, flood and earth movement, if in a flood or quake zone, and, if applicable, equipment breakdown including testing. The City and County of Denver, Contractor, and sub-contractors shall be Additional Named Insureds under the policy. Policy shall remain in force until acceptance of the project by the City.

#### (10) Additional Provisions:

(a) For Commercial General Liability, the policies must provide the following:

- (i) That this Agreement is an Insured Contract under the policy;
  - (ii) Defense costs in excess of policy limits;
  - (iii) A severability of interests or separation of insureds provision (no insured vs. insured exclusion); and
  - (iv) A provision that coverage is primary and non-contributory with other coverage or selfinsurance maintained by the City.

(b) For claims-made coverage:

- (i) The retroactive date must be on or before the contract date or the first date when any goods or services were provided to the City, whichever is earlier
- (c) Contractor shall advise the City in the event any general aggregate or other aggregate limits are reduced below the required per occurrence limits. At their own expense, and where such general aggregate or other aggregate limits have been reduced below the required per occurrence limit, the Contractor will procure such per occurrence limits and furnish a new certificate of insurance showing such coverage is in force.

General Condition 1602, INDEMNIFICATION, is modified to read in full as follows:

#### **DEFENSE AND INDEMNIFICATION**

- (a) To the fullest extent permitted by law, the Contractor hereby agrees to defend, indemnify, and hold harmless City, its appointed and elected officials, agents and employees against all liabilities, claims, judgments, suits or demands for damages to persons or property arising out of, resulting from, or related to the work performed under this Contract that are due to the negligence or fault of the Contractor or the Contractor's agents, representatives, subcontractors, or suppliers ("Claims"). This indemnity shall be interpreted in the broadest possible manner consistent with the applicable law to indemnify the City.
- (b) Contractor's duty to defend and indemnify City shall arise at the time written notice of the Claim is first provided to City regardless of whether suit has been filed and even if Contractor is not named as a Defendant.
- (c) Contractor will defend any and all Claims which may be brought or threatened against City and will pay on behalf of City any expenses incurred by reason of such Claims including, but not limited to, court costs and attorney fees incurred in defending and investigating such Claims or seeking to enforce this indemnity obligation. Such payments on behalf of City shall be in addition to any other legal remedies available to City and shall not be considered City's exclusive remedy.
- (d) Insurance coverage requirements specified in this Contract shall in no way lessen or limit the liability of the Contractor under the terms of this indemnification obligation. The Contractor shall obtain, at its own expense, any additional insurance that it deems necessary for the City's protection.
- (e) This defense and indemnification obligation shall survive the expiration or termination of this Contract.

#### SC-21 GREENPRINT DENVER REQUIREMENTS

In accordance with the City and County of Denver Executive Order 123: Green print Denver Office and Sustainability Policy (dated October 27, 2007), and the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) program, Contractor shall, wherever possible, recycle construction and demolition waste, and install building materials that contain recycled content. Non-hazardous solid waste that is eligible for reuse or recycling is not subject to the DADS disposal requirement defined in SC-14. The Contractor shall recycle and/or reuse construction and demolition waste and implement sustainable development practices on construction projects in compliance with any Project Requirements of the Better Denver Program Sustainability Form that are included in the Contract Documents.

At the Project Pre-Construction Meeting, the Contractor shall provide a written summary of how the Contractor intends to meet any applicable Project Requirement, and the type of documentation to be provided. The Contractor shall maintain and keep current documentation of the materials recycled or reused, organized in accordance with any applicable Closeout Form for Contractors provided in the Contract Documents for the duration of the Project. A copy of the completed Closeout Form, the quantity tabulation, and all supporting documentation for materials recycled shall be delivered to the Project Manager as a submittal requirement of Final Acceptance.

#### SC-22 CITY AUDITOR AND MANAGER OF FINANCE

Section 211, City Auditor, of the General Contract Conditions, 1999 Edition, is amended to read in its entirety as follows:

#### 211 CITY AUDITOR AND MANAGER OF FINANCE

The City Auditor, an independent elected official, reviews certified payrolls for compliance with prevailing wage requirements before payment is made to a Contractor. The City's Manager of Finance pays the Contractor for Work approved under the Contract.

#### SC-23 NO EMPLOYMENT OF ILLEGAL ALIENS TO PERFORM WORK UNDER THE AGREEMENT:

**a.** This Agreement is subject to Division 5 of Article IV of Chapter 20 of the Denver Revised Municipal Code, and any amendments (the "Certification Ordinance").

#### **b.** The Contractor certifies that:

- (1) At the time of its execution of this Agreement, it does not knowingly employ or contract with an illegal alien who will perform work under this Agreement.
- (2) It will participate in the E-Verify Program, as defined in § 8-17.5-101(3.7), C.R.S., to confirm the employment eligibility of all employees who are newly hired for employment to perform work under this Agreement.
- c. The Contractor also agrees and represents that:
  - (1) It shall not knowingly employ or contract with an illegal alien to perform work under the Agreement.
  - (2) It shall not enter into a contract with a subconsultant or subcontractor that fails to certify to the Contractor that it shall not knowingly employ or contract with an illegal alien to perform work under the Agreement.
  - (3) It has confirmed the employment eligibility of all employees who are newly hired for employment to perform work under this Agreement, through participation in the E-Verify Program.
  - (4) It is prohibited from using the E-Verify Program procedures to undertake pre-employment screening of job applicants while performing its obligations under the Agreement, and that otherwise requires the Contractor to comply with any and all federal requirements related to use of the E-Verify Program including, by way of example, all program requirements related to employee notification and preservation of employee rights.
  - (5) If it obtains actual knowledge that a subconsultant or subcontractor performing work under the Agreement knowingly employs or contracts with an illegal alien, it will notify such subconsultant or subcontractor and the City within three (3) days. The Contractor will also then terminate such subconsultant or subcontractor if within three (3) days after such notice the subconsultant or subcontractor does not stop employing or contracting with the illegal alien, unless during such three-day period the subconsultant or subcontractor provides information to establish that the subconsultant or subcontractor has not knowingly employed or contracted with an illegal alien.
  - (6) It will comply with any reasonable request made in the course of an investigation by the Colorado Department of Labor and Employment under authority of § 8-17.5-102(5), C.R.S, or the City Auditor, under authority of D.R.M.C. 20-90.3.

**d.** The Contractor is liable for any violations as provided in the Certification Ordinance. If Contractor violates any provision of this section or the Certification Ordinance, the City may terminate this Agreement for a breach of the Agreement. If the Agreement is so terminated, the Contractor shall be liable for actual and consequential damages to the City. Any such termination of a contract due to a violation of this section or the Certification Ordinance may also, at the discretion of the City, constitute grounds for disqualifying Contractor from submitting bids or proposals for future contracts with the City.

#### SC-24 RETAINAGE:

Section 908.1, of the General Contract Conditions, 1999 Edition, is amended to read as follows:

.1 The City shall deduct and retain a total of five percent (5%) from the total amount of approved applications for payment, including Change Orders. The City may also deduct in addition to retainage as stated above, the additional amount(s) of any and all outstanding claims pursuant to C.R.S. §38-26-107 from each approved application for payment.

#### CITY AND COUNTY OF DENVER DEPARTMENT OF PUBLIC WORKS

#### PERFORMANCE AND PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned <u>Golden Triangle Construction, Inc.</u>, a corporation organized and existing under and by virtue of the laws of the State of <u>COLORADO</u>, hereafter referred to as the "Contractor", and <u>Hartford Accident and Indemnity Company</u>, a corporation organized and existing under and by virtue of the laws of the State of <u>CONNETICUT</u>, and authorized to transact business in the State of Colorado, as Surety, are held and firmly bound unto the <u>CITY AND COUNTY OF DENVER</u>, a municipal corporation of the State of Colorado, hereinafter referred to as the "City", in the penal sum of <u>One Million One Hundred Eighty-Six Thousand One Hundred Dollars and No Cents</u> (<u>\$1,186,100.00</u>), lawful money of the United States of America, for the payment of which sum, well and truly to be made, we bind ourselves and our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents;

#### THE CONDITION OF THE FOREGOING OBLIGATION IS SUCH THAT:

WHEREAS, the above bounden Contractor has entered into a written contract with the aforesaid City for furnishing all labor and tools, supplies, equipment, superintendence, materials and everything necessary for and required to do, perform and complete the construction of CONTRACT NO. 201206436 DENVER POLICE DEPARTMENT COMMAND VEHICLE GARAGE, Denver, Colorado, and has bound itself to complete the project within the time or times specified or pay liquidated damages, all as designated, defined and described in the said Contract and Conditions thereof, and in accordance with the Plans and Technical Specifications therefore, a copy of said Contract being made a part hereof;

NOW, THEREFORE, if the said Contractor shall and will, in all particulars well and truly and faithfully observe, perform and abide by each and every Covenant, Condition and part of said Contract, and the Conditions, Technical Specifications, Plans, and other Contract Documents thereto attached, or by reference made a part thereof and any alterations in and additions thereto, according to the true intent and meaning in such case, then this obligation shall be and become null and void; otherwise, it shall remain in full force and effect;

PROVIDED FURTHER, that if the said Contractor shall satisfy all claims and demands incurred by the Contractor in the performance of said Contract, and shall fully indemnify and save harmless the City from all damages, claims, demands, expense and charge of every kind (including claims of patent infringement) arising from any act, omission, or neglect of said Contractor, its agents, or employees with relation to said work; and shall fully reimburse and repay to the City all costs, damages, and expenses which it may incur in making good any default based upon the failure of the Contractor to fulfill its obligation to furnish maintenance, repairs or replacements for the full guarantee period provided in the Contract Documents, then this obligation shall be null and void; otherwise it shall remain in full force and effect;

PROVIDED FURTHER, that if said Contractor shall at all times promptly make payments of all amounts lawfully due to all persons supplying or furnishing it or its subcontractors with labor and materials, rental machinery, tools or equipment used or performed in the prosecution of work provided for in the above Contract and that if the Contractor will indemnify and save harmless the City for the extent of any and all payments in connection with the carrying out of such Contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect;

PROVIDED FURTHER, that if the said Contractor fails to duly pay for any labor, materials, team hire, sustenance, provisions, provender, gasoline, lubricating oils, fuel oils, grease, coal, or any other supplies or materials used or consumed by said Contractor or its subcontractors in performance of the work contracted to be done, or fails to pay any person who supplies rental machinery, tools or equipment, all amounts due as the result of the use of such machinery, tools or equipment in the prosecution of the work, the Surety will pay the same in any amount not exceeding the amount of this obligation, together with interest as provided by law;

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PROVIDED FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract, or to contracts with others in connection with this project, or the work to be performed thereunder, or the Technical Specifications and Plans accompanying the same, shall in any way affect its obligation on this bond and it does hereby waive notice of any change, extension of time, alteration or addition to the terms of the Contract, or contracts, or to the work, or to the Technical Specifications and Plans.

IN WITNESS WHEREOF, said Contractor, and said Surety have executed these presents as of this ろういや \_\_\_\_, 20 2. day of \_

Attest: -Secretary Sayaros/Moharhed, Assistant Secretary

<u>Golden</u> Con Contra By President, Brian Laartz Hartford Accident and Indemnity Company Surety

By: <u>Attorney-In-Fact</u> Florietta Acosta

(Accompany this bond with Attorney-in-Fact's authority from the Surety to execute bond, certified to include the date of the bond).

APPROVED AS TO FORM: Attorney for the City and County of Denver

By **Assistant City Attorney** 

| APPR<br>DEN | OVED FOR THE CITY AND COUNTY OF |
|-------------|---------------------------------|
| Ву          |                                 |
|             | MAYOR                           |
| By:         | MANAGER OF PUBLIC WORKS         |

# POWER OF ATTORNEY

THE HARTFORD

One Hartford Plaza Hartford, Connecticut 06155 call: 888-266-3488 or fax: 860-757-5835

Agency Code: 34-341300

#### NOW ALL PERSONS BY THESE PRESENTS THAT:

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Hartford Fire Insurance Company, a corporation duly organized under the laws of the State of Connecticut

Hartford Casualty Insurance Company, a corporation duly organized under the laws of the State of Indiana

Hartford Accident and Indemnity Company, a corporation duly organized under the laws of the State of Connecticut

Hartford Underwriters Insurance Company, a corporation duly organized under the laws of the State of Connecticut

Twin City Fire Insurance Company, a corporation duly organized under the laws of the State of Indiana

Hartford Insurance Company of Illinois, a corporation duly organized under the laws of the State of Illinois

Hartford Insurance Company of the Midwest, a corporation duly organized under the laws of the State of Indiana

Hartford Insurance Company of the Southeast, a corporation duly organized under the laws of the State of Florida

having their home office in Hartford, Connecticut, (hereinafter collectively referred to as the "Companies") do hereby make, constitute and appoint, up to the amount of unlimited:

J. R. Richards, Dilynn Guem, Kevin W. McMahon, Donald E. Appleby, Gloria C. Blackburn, Florietta Acosta,

Susan J. Lattarulo, Tiffany McGonigle, Mark Sweigart, Sarah Brown, Anne E. Hill

of Denver, CO

their true and lawful Attorney(s)-in-Fact, each in their separate capacity if more than one is named above, to sign its name as surety(ies) only as delineated above by 🔯, and to execute, seal and acknowledge any and all bonds, undertakings, contracts and other written instruments in the nature thereof, on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

In Witness Whereof, and as authorized by a Resolution of the Board of Directors of the Companies on January 22, 2004 the Companies have caused these presents to be signed by its Assistant Vice President and its corporate seals to be hereto affixed, duly attested by its Assistant Secretary. Further, pursuant to Resolution of the Board of Directors of the Companies, the Companies hereby unambiguously affirm that they are and will be bound by any mechanically applied signatures applied to this Power of Attorney.



Wesley W. Cowling, Assistant Secretary

M. Ross Fisher, Assistant Vice President

STATE OF CONNECTICUT

### COUNTY OF HARTFORD

On this 3<sup>rd</sup> day of November, 2008, before me personally came M. Ross Fisher, to me known, who being by me duly sworn, did depose and say: that he resides in the County of Hartford, State of Connecticut; that he is the Assistant Vice President of the Companies, the corporations described in and which executed the above instrument; that he knows the seals of the said corporations; that the seals affixed to the said instrument are such corporate seals; that they were so affixed by authority of the Boards of Directors of said corporations and that he signed his name thereto by like authority.



Scott E. Paseka Notary Public My Commission Expires October 31, 2012

I, the undersigned, Assistant Vice President of the Companies, DO HEREBY CERTIFY that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which is still in full force effective as of Signed and sealed at the City of Hartford.



Gary W. Stumper, Assistant Vice President

| MA<br>A |
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DENVER THE MILE HIGH CITY Department of Public Works Engineering Department

201 W. Colfax Avenue Denver, CO 80202 www.denvergov.org/PublicWorks

#### PERFORMANCE AND PAYMENT BOND SURETY AUTHORIZATION

| FAX NUMBER:       | 720-913-3183 |
|-------------------|--------------|
| TELEPHONE NUMBER: | 720-913-3267 |

Assistant City Attorney 201 W. Colfax Ave. Dept 1207

Denver, Colorado 80202

RE: Golden Triangle Construction, Inc.

| Contract No:                       |
|------------------------------------|
| Project Name:                      |
| Contract Amount:                   |
| Performance and Payment Bond No .: |

201206436 DENVER POLICE DEPARTMENT COMMAND VEHICLE GARAGE \$1,186,100.00 34BCSGG8049

Dear Assistant City Attorney,

We hereby authorize the City and County of Denver, Department of Public Works, to date all bonds and powers of attorney to coincide with the date of the contract.

If you should have any additional questions or concerns, please don't hesitate to give me a call at 303-722-7776

Thank you.

Sincerely.

cesta Sloritt

Florietta Acosta Attorney-In-Fact



Contract No. 201206436 DPD CVG BDP - 49

June 6, 2012

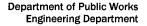
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|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|---------------|-------|-------------------------|-------|--------------|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------|----------------------------|-------------------------------------------------|----------------------------|-----------------------------------------|
| (<br>  E<br>  F                                                                                                                    | THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS<br>CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES<br>BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED<br>REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER. |                                                     |               |       |                         |       |              |                                                                            |                                                                                                 |                            |                            |                                                 |                            |                                         |
| t                                                                                                                                  | IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).                                                                      |                                                     |               |       |                         |       |              |                                                                            |                                                                                                 |                            |                            |                                                 |                            |                                         |
|                                                                                                                                    | DUC                                                                                                                                                                                                                                                                                                                                                                                                              |                                                     |               |       |                         |       |              |                                                                            | CONT/<br>NAME:                                                                                  | ACT                        |                            |                                                 |                            |                                         |
|                                                                                                                                    | Willis of Colorado, Inc.         PHONE<br>(A/C, No, Ext): 303 722-7776         FAX<br>(A/C, No): 303-722-8862           2000 South Colorado, Boulovard         FAX         303-722-8862                                                                                                                                                                                                                          |                                                     |               |       |                         |       |              |                                                                            |                                                                                                 |                            |                            |                                                 | '22-8862                   |                                         |
| 2000 South Colorado Boulevard                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                     |               |       |                         |       |              |                                                                            |                                                                                                 |                            |                            |                                                 |                            |                                         |
| Tower II, Suite 900       INSURER(S) AFFORDING COVERAGE         Denver, CO 80222       INSURER A : National Fire Ins. Company of H |                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                     |               |       |                         |       |              |                                                                            |                                                                                                 |                            |                            | NAIC #                                          |                            |                                         |
|                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                  | · · · · · · · · · · · · · · · · · · ·               |               |       |                         |       |              |                                                                            |                                                                                                 |                            |                            |                                                 |                            | 20478                                   |
| INS                                                                                                                                | JRED                                                                                                                                                                                                                                                                                                                                                                                                             |                                                     | rian          | ale   | Construc                | tion  | . Inc        |                                                                            |                                                                                                 |                            |                            | re Insurance o                                  |                            | 19445<br>41190                          |
|                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                  | 700 Weav                                            |               | -     |                         |       | ,            | -                                                                          |                                                                                                 |                            | ol Assuran                 | alty Company                                    |                            | 20443                                   |
|                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                  | Longmor                                             | nt, C         | :0 8  | 80501                   |       |              |                                                                            |                                                                                                 |                            |                            | can Insurance Co                                |                            | 20443                                   |
|                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                  | -                                                   |               |       |                         |       |              |                                                                            |                                                                                                 |                            | acon amen                  |                                                 |                            | 20021                                   |
|                                                                                                                                    | VFR                                                                                                                                                                                                                                                                                                                                                                                                              | AGES                                                |               |       | CER                     |       |              | NUMBER:                                                                    | INSURI                                                                                          | <u>:KF:</u>                |                            | REVISION NUMBER:                                |                            |                                         |
| _                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                     | THA           | TT    |                         |       | _            | RANCE LISTED BELOW HA                                                      | VE BEE                                                                                          | N ISSUED TO                |                            |                                                 | E POLIC                    | Y PERIOD                                |
| 11<br>C                                                                                                                            | IDIC/<br>ERTI                                                                                                                                                                                                                                                                                                                                                                                                    | ATED. NOTWITH<br>FICATE MAY BE                      | HSTA<br>E ISS |       | NG ANY RE               | QUIR  | EMEN<br>AIN, | IT, TERM OR CONDITION C<br>THE INSURANCE AFFORDE<br>5. LIMITS SHOWN MAY HA | DF ANY                                                                                          | CONTRACT O                 | R OTHER DO<br>DESCRIBED    | CUMENT WITH RESPECT<br>HEREIN IS SUBJECT TO     | то wh                      | IICH THIS                               |
| INSF<br>LTR                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                  | TYPE OF                                             | INSUF         | RANC  | E                       | ADDI  | SUBF         | POLICY NUMBER                                                              |                                                                                                 | POLICY EFF<br>(MM/DD/YYYY) | POLICY EXP<br>(MM/DD/YYYY) | LIMI                                            | TS                         |                                         |
| Α                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                  | NERAL LIABILITY                                     |               |       |                         | 1     |              | 2022866738                                                                 |                                                                                                 |                            |                            | EACH OCCURRENCE                                 | \$1,00                     | 0,000                                   |
|                                                                                                                                    | X                                                                                                                                                                                                                                                                                                                                                                                                                | COMMERCIAL GE                                       |               |       | BILITY                  |       |              |                                                                            |                                                                                                 |                            |                            | DAMAGE TO RENTED<br>PREMISES (Ea occurrence)    | \$500,                     | 000                                     |
|                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                  | CLAIMS-MAE                                          | DE            | X     | OCCUR                   | 1     |              |                                                                            |                                                                                                 |                            |                            | MED EXP (Any one person)                        | \$5,00                     | 0                                       |
|                                                                                                                                    | X                                                                                                                                                                                                                                                                                                                                                                                                                | G140331B 1                                          | 10/10         | 0     |                         |       | ľ            |                                                                            |                                                                                                 |                            |                            | PERSONAL & ADV INJURY                           | \$1,000,000<br>\$2,000,000 |                                         |
|                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                     |               |       |                         |       |              |                                                                            |                                                                                                 |                            |                            | GENERAL AGGREGATE                               |                            |                                         |
|                                                                                                                                    | GEN                                                                                                                                                                                                                                                                                                                                                                                                              |                                                     |               | PPLIE | ES PER:                 |       |              |                                                                            |                                                                                                 |                            |                            | PRODUCTS - COMP/OP AGG                          | \$2,00                     | 0,000                                   |
|                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                     | RO-<br>ICT    |       | LOC                     |       |              |                                                                            |                                                                                                 |                            |                            |                                                 | \$                         |                                         |
| D                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                  | OMOBILE LIABILIT                                    | TΥ            |       |                         |       |              | 2022866741                                                                 |                                                                                                 | 12/31/2011                 | 12/31/2012                 | COMBINED SINGLE LIMIT<br>(Ea accident)          | \$1,00                     | 0,000                                   |
| 1                                                                                                                                  | X                                                                                                                                                                                                                                                                                                                                                                                                                | ANY AUTO<br>ALL OWNED                               | ()            | SCH   | IEDULED                 |       |              |                                                                            |                                                                                                 |                            |                            | BODILY INJURY (Per person)                      | \$                         |                                         |
|                                                                                                                                    | v                                                                                                                                                                                                                                                                                                                                                                                                                | AUTOS                                               | x             | AUT   | OS<br>I-OWNED           |       |              |                                                                            |                                                                                                 |                            |                            | BODILY INJURY (Per accident)<br>PROPERTY DAMAGE | \$                         |                                         |
|                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                  | HIRED AUTOS                                         |               | AUT   | OS                      |       |              |                                                                            |                                                                                                 |                            |                            | (Per accident)                                  | \$                         |                                         |
| в                                                                                                                                  | x                                                                                                                                                                                                                                                                                                                                                                                                                | UMBRELLA LIAB                                       |               |       |                         |       |              | BE23465099                                                                 |                                                                                                 | 12/21/2011                 | 12/21/2012                 |                                                 | \$7,000                    | 0.000                                   |
|                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                  | EXCESS LIAB                                         | -             |       | OCCUR<br>CLAIMS-MADE    |       |              | BL23403099                                                                 | 12/31/2011 12/31/2012                                                                           |                            |                            | AGGREGATE \$7.000.0                             |                            |                                         |
|                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                     | ⊥<br>≂NTIO    |       |                         |       |              |                                                                            |                                                                                                 |                            |                            | AGGREGATE                                       | \$                         | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, |
| С                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                  | RKERS COMPENSA                                      | ATION         |       |                         |       |              | 4013024                                                                    |                                                                                                 | 01/01/2012                 | 01/01/2013                 | X WC STATU-<br>TORY LIMITS OTH-<br>ER           |                            |                                         |
|                                                                                                                                    | ANU                                                                                                                                                                                                                                                                                                                                                                                                              | EMPLOYERS' LIAI<br>PROPRIETOR/PAR<br>CER/MEMBER EXC | STNER         | VEXE  |                         |       | l            |                                                                            |                                                                                                 | 0 1/0 1/2012               | 01/01/2010                 | E.L. EACH ACCIDENT                              | \$1,000                    | 0,000                                   |
|                                                                                                                                    | (Mar                                                                                                                                                                                                                                                                                                                                                                                                             | idatory in NH)                                      | LUDE          | :07   | Y                       | N/A   |              |                                                                            |                                                                                                 |                            |                            | E.L. DISEASE - EA EMPLOYEE                      |                            |                                         |
|                                                                                                                                    | If yes<br>DES                                                                                                                                                                                                                                                                                                                                                                                                    | s, describe under<br>CRIPTION OF OPE                | RATIC         | NS b  | elow                    |       |              |                                                                            |                                                                                                 |                            |                            | E.L. DISEASE - POLICY LIMIT                     | \$1,000                    | ),000                                   |
| Е                                                                                                                                  | Bla                                                                                                                                                                                                                                                                                                                                                                                                              | nket Builder'                                       | 's            |       |                         |       |              | 790005057                                                                  |                                                                                                 | 12/31/2011                 | 12/31/2012                 | \$10,000,000 Limit                              |                            |                                         |
|                                                                                                                                    | Ris                                                                                                                                                                                                                                                                                                                                                                                                              | k                                                   |               |       |                         |       |              |                                                                            |                                                                                                 |                            |                            | Less Ded.: \$1,000                              |                            |                                         |
|                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                     |               |       |                         |       |              |                                                                            |                                                                                                 |                            |                            |                                                 |                            |                                         |
|                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                     |               |       |                         |       |              | ACORD 101, Additional Remarks<br>nt Command Vehicles                       |                                                                                                 |                            | s required)                |                                                 |                            |                                         |
|                                                                                                                                    | -                                                                                                                                                                                                                                                                                                                                                                                                                | ct No. 201206                                       |               |       |                         | epa   | une          | int command vehicles                                                       | Uarag                                                                                           | <b>j</b> e                 |                            |                                                 |                            |                                         |
|                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                     |               |       |                         |       |              |                                                                            |                                                                                                 |                            |                            |                                                 |                            |                                         |
| The                                                                                                                                | Cit                                                                                                                                                                                                                                                                                                                                                                                                              | y and County                                        | v of          | Der   | nver. its e             | lecte | d an         | nd appointed officials,                                                    | emplo                                                                                           | vees and v                 | olunteers a                | re named as                                     |                            |                                         |
|                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                     | -             |       |                         |       |              | ercial General Liability                                                   | -                                                                                               | -                          |                            |                                                 |                            |                                         |
| Pol                                                                                                                                | Policy.                                                                                                                                                                                                                                                                                                                                                                                                          |                                                     |               |       |                         |       |              |                                                                            |                                                                                                 |                            |                            |                                                 |                            |                                         |
|                                                                                                                                    | CERTIFICATE HOLDER CANCELLATION                                                                                                                                                                                                                                                                                                                                                                                  |                                                     |               |       |                         |       |              |                                                                            |                                                                                                 |                            |                            |                                                 |                            |                                         |
|                                                                                                                                    | <u>, (11)</u>                                                                                                                                                                                                                                                                                                                                                                                                    |                                                     |               |       |                         |       |              |                                                                            | - OANO                                                                                          |                            |                            |                                                 |                            |                                         |
|                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                  | City and                                            | l Co          | unf   | v of Denv               | er    |              |                                                                            |                                                                                                 |                            |                            | SCRIBED POLICIES BE CA                          |                            |                                         |
|                                                                                                                                    | City and County of Denver<br>Department of Public Works                                                                                                                                                                                                                                                                                                                                                          |                                                     |               |       |                         |       |              |                                                                            | THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS. |                            |                            |                                                 |                            |                                         |
|                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                     |               |       | x, Dept. 6 <sup>.</sup> |       |              |                                                                            |                                                                                                 |                            |                            |                                                 |                            |                                         |
| }                                                                                                                                  | Denver, CO 80202                                                                                                                                                                                                                                                                                                                                                                                                 |                                                     |               |       |                         |       |              |                                                                            | AUTHORIZED REPRESENTATIVE                                                                       |                            |                            |                                                 |                            |                                         |

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8GOLDTRI1

Client#: 51920

8RROM



201 W. Colfax Avenue Denver, CO 80202 www.denvergov.org/PublicWorks



#### NOTICE OF APPARENT LOW BIDDER (SAMPLE)

Current Date

To:

Gentlemen:

The MANAGER OF PUBLIC WORKS has considered the Bids submitted on <u>July 12, 2012</u> for work to be done and materials to be furnished in and for:

#### PROJECT No. 201206436 DENVER POLICE DEPARTMENT COMMAND VEHICLE GARAGE

as set forth in detail in the Contract Documents for the City and County of Denver, Colorado. It appears that your Bid is fair, equitable, and to the best interest of the City and County; therefore, said Bid is hereby accepted at the bid price contained herein, subject to execution of the Contract Documents and your furnishing the items specified below, the total cost thereof (Contract Amount Written), (Contract Amount Numeric).

It will be necessary for you to appear forthwith at the office of the Department of Public Works, Engineering Division, Project Management Office, 201 W. Colfax Ave., Denver, Colorado 80202, to receive the said Contract Documents, execute the same and return them to the Department of Public Works, Finance and Administration, within the time limit set forth in the Bid Proposal.

In accordance with the requirements set forth in the Contract Documents, you are required to furnish the following documents:

- a. Insurance Certificates: General Liability and Automotive Liability, Workman's Compensation and Employer Liability; or any other coverage required by the contract; and
- b. One original plus four copies of the Power of Attorney relative to Performance and/or Payment Bond;

All construction Contracts made and entered into by the City and County of Denver are subject to Affirmative Action and Equal Opportunity Rules and Regulations, as adopted by the Manager of Public Works, and each contract requiring payment by the City of one-half million dollars (\$500,000.00) or more shall first be approved by the City Council acting by ordinance and in accordance with Section 3.2.6 of the Charter of the City and County of Denver.

Prior to issuance of Notice to Proceed, all Equal Opportunity requirements must be completed. Additional information may be obtained by contacting the Director of Contract Compliance at (720-913-1700).



#### NOTICE OF APPARENT LOW BIDDER (SAMPLE)

#### PROJECT NO. <u>201206436</u> Page 2

The Bid Security submitted with your Bid, will be returned upon execution of the Contract and furnishing of the Performance Bond. In the event you should fail to execute the Contract and to furnish the performance Bond within the time limit specified, said Bid Security will be retained by the City and County of Denver as liquidated damages, and not as a penalty for the delay and extra work caused thereby.

Dated at Denver, Colorado this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_.

#### CITY AND COUNTY OF DENVER

By

Manager of Public Works

Department of Public Works Engineering Department

201 W. Colfax Avenue Denver, CO 80202 www.denvergov.org/PublicWorks



Current Date

#### NOTICE TO PROCEED (SAMPLE)

Name Company Street City/State/Zip

### CONTRACT NO. <u>201206436, DENVER POLICE DEPARTMENT COMMAND VEHICLE</u> GARAGE

In accordance with General Contract Condition 302 of the Standard Specifications for Construction, General Contract Conditions, 1999 Edition, you are hereby authorized and directed to proceed on \_\_\_\_\_\_ with the work of constructing contract number \_\_\_\_\_\_ 201206436, as set forth in detail in the contract documents for the City and County of Denver.

With a contract time of calendar days, the project must be complete on or before \_\_\_\_\_.

If you have not already done so, you must submit your construction schedule, in accordance with General Contract Condition 306.2.B, to the Project Manager within 10 days. Additionally, you must submit your tax exempt certificate, and copies of your subcontractors' certificates, in accordance with General Contract Condition 322.5, to the Project Manager as soon as possible. Failure to submit these certificates will delay processing of payment applications.

Sincerely,

Lesley B. Thomas City Engineer

cc:



#### Department of Public Works Engineering Department

201 W. Colfax Avenue Denver, CO 80202 www.denvergov.org/PublicWorks



### Certificate of Contract Release

(SAMPLE)

Date

Name Company Street City/State/Zip

#### RE: Certificate of Contract Release for 201206436, DENVER POLICE DEPARTMENT COMMAND VEHICLE GARAGE

Received this date of the City and County of Denver, as full and final payment of the cost of the improvements provided for in the foregoing contract, \_\_\_\_\_\_ dollars and \_\_\_\_\_\_ cents (\$\_\_\_\_\_\_), in cash, being the remainder of the full amount accruing to the undersigned by virtue of said contract; said cash also covering and including full payment for the cost of all extra work and material furnished by the undersigned in the construction of said improvements, and all incidentals thereto, and the undersigned hereby releases said City and County of Denver from any and all claims or demands whatsoever, regardless of how denominated, growing out of said contract.

And these presents are to certify that all persons performing work upon or furnishing materials for said improvements under the foregoing contract have been paid in full and this payment to be made is the last or final payment.

Contractor's Signature

Date Signed

If there are any questions, please contact me by telephone at (720) 913-XXXX. Please return this document via facsimile at (720) 913-1805 and mail to original to the above address.



# CITY AND COUNTY OF DENVER

## STATE OF COLORADO



# **PREVAILING WAGE RATES**

## **Contract No. 201206436**

## DENVER POLICE DEPARTMENT COMMAND VEHICLE GARAGE

### June 6, 2012

#### Career Service Authority Denver's Human Resource Agency



201 W. Colfax, Department 412 Denver, CO 80202

p: 720.913.5751 f: 720.913.5720 www.denvergov.org/csa

TO: All Users of the City of Denver Prevailing Wage Schedules

FROM: Seth Duhon-Thornton, Staff Human Resource Professional

DATE: Friday April 27, 2012

SUBJECT: Latest Change to Prevailing Wage Schedules

Please be advised, prevailing wage rates for some building, heavy, and highway construction trades have not been updated by the United States Department of Labor (DOL) since March 1, 2002. The Career Service Authority Board, in their meeting held on April 21, 2011, approved the use of the attached supplemental wage rates until prevailing wage rates for these classifications of work are again published by the United States Department of Labor in accordance with the Davis-Bacon Act. The rates will be provided as a supplemental to the Davis-Bacon Heavy rates issued by CSA.

The effective date for this publication will be **Friday April 27, 2012** and applies to the City and County of Denver for **HEAVY CONSTRUCTION PROJECTS** in accordance with the Denver Revised Municipal Code, Section 20-76(c).

General Wage Decision No. CO120012 Superseded General Decision No. CO20100012

#### Modification No. 3 Publication Date: 04/20/2012 (10 pages)

Unless otherwise specified in this document, apprentices shall be permitted only if they are employed pursuant to, and individually registered in, a bona fide apprenticeship program registered with the U.S. Department. Of Labor (DOL). The employer and the individual apprentice must be registered in a program, which has received prior approval, by the DOL. Any employer, who employs an apprentice and is found to be in violation of this provision, shall be required to pay said apprentice the full journeyman scale.

For questions please call (720) 913-5018

Attachments as listed above.



General Decision Number: CO120012 04/20/2012 CO12

Superseded General Decision Number: CO20100012

State: Colorado

Construction Type: Heavy

Counties: Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, El Paso, Jefferson, Larimer, Mesa, Pueblo and Weld Counties in Colorado.

#### HEAVY CONSTRUCTION PROJECTS

| Modification | Number | Publication | Date |
|--------------|--------|-------------|------|
| 0            |        | 01/06/2012  |      |
| 1            |        | 01/13/2012  |      |
| 2            |        | 01/27/2012  |      |
| . 3          |        | 04/20/2012  |      |
|              |        |             |      |

ASBE0028-001 07/01/2010

#### Rates

Fringes

Asbestos Workers/Insulator (Includes application of all insulating materials, protective coverings, coatings and finishings to all types of mechanical

systems).....\$ 30.23 11.53

BRC00007-004 01/01/2011

\_\_\_\_\_\_

ADAMS, ARAPAHOE, BOULDER, BROOMFIELD, DENVER, DOUGLAS AND JEFFERSON COUNTIES

|                                                                                     | Rates    | Fringes |
|-------------------------------------------------------------------------------------|----------|---------|
| BRICKLAYER                                                                          | \$ 22.13 | 9.89    |
| BRC00007-006 06/01/2011                                                             |          |         |
| EL PASO AND PUEBLO COUNTIES                                                         |          |         |
|                                                                                     | Rates    | Fringes |
| BRICKLAYER                                                                          |          | 9.88    |
| ELEC0012-004 09/01/2011                                                             |          |         |
| PUEBLO COUNTY                                                                       |          |         |
|                                                                                     | Rates    | Fringes |
| ELECTRICIAN                                                                         |          |         |
| Electrical work where the<br>cost is \$150,000 or less<br>Electrical work where the | \$ 24.25 | 11.83   |
| cost is over \$150,000                                                              | \$ 26.75 | 11.90   |

#### ELEC0068-001 06/01/2011

ADAMS, ARAPAHOE, BOULDER, BROOMFIELD, DENVER, DOUGLAS, JEFFERSON, LARIMER, AND WELD COUNTIES

|                                                                                                                                                                                                                                                                                                                                                          | Rates                                                                                                    | Fringes                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| ELECTRICIAN                                                                                                                                                                                                                                                                                                                                              |                                                                                                          | 12.52                                                        |
| ELEC0111-001 09/01/2010                                                                                                                                                                                                                                                                                                                                  |                                                                                                          |                                                              |
|                                                                                                                                                                                                                                                                                                                                                          | Rates                                                                                                    | Fringes                                                      |
| Line Construction:<br>Cable Splicer<br>Equipment Operator-                                                                                                                                                                                                                                                                                               | \$ 28.65                                                                                                 | 13.75%+4.75                                                  |
| Underground<br>Groundman<br>Line Equipment Operator<br>Lineman and Welder                                                                                                                                                                                                                                                                                | \$ 20.48<br>\$ 25.74                                                                                     |                                                              |
| ELEC0113-002 06/01/2011                                                                                                                                                                                                                                                                                                                                  |                                                                                                          |                                                              |
| EL PASO COUNTY                                                                                                                                                                                                                                                                                                                                           |                                                                                                          |                                                              |
|                                                                                                                                                                                                                                                                                                                                                          | Rates                                                                                                    | Fringes                                                      |
| ELECTRICIAN                                                                                                                                                                                                                                                                                                                                              | \$ 28.55                                                                                                 | 14.46                                                        |
| ELEC0969-002 06/01/2010                                                                                                                                                                                                                                                                                                                                  |                                                                                                          |                                                              |
| MESA COUNTY                                                                                                                                                                                                                                                                                                                                              |                                                                                                          |                                                              |
|                                                                                                                                                                                                                                                                                                                                                          | Rates                                                                                                    | Fringes                                                      |
| ELECTRICIAN                                                                                                                                                                                                                                                                                                                                              |                                                                                                          | 5.66                                                         |
| ENGI0009-001 05/01/2011                                                                                                                                                                                                                                                                                                                                  |                                                                                                          |                                                              |
|                                                                                                                                                                                                                                                                                                                                                          | Rates                                                                                                    | Fringes                                                      |
| Power equipment operators:<br>Blade: Finish<br>Blade: Rough<br>Bulldozer<br>Cranes: 50 tons and under<br>Cranes: 51 to 90 tons<br>Cranes: 91 to 140 tons<br>Cranes: 141 tons and over.<br>Forklift<br>Mechanic<br>Oiler<br>Scraper: Single bowl<br>under 40 cubic yards<br>Scraper: Single bowl,<br>including pups 40 cubic<br>yards and over and tandem | \$ 23.67<br>\$ 23.67<br>\$ 23.82<br>\$ 23.97<br>\$ 24.12<br>\$ 24.88<br>\$ 23.32<br>\$ 25.97<br>\$ 22.97 | 9.22<br>9.22<br>9.22<br>9.22<br>9.22<br>9.22<br>9.22<br>9.22 |

IRON0024-003 07/01/2011

|                                                                | Rates    | Fringes    |                                       |
|----------------------------------------------------------------|----------|------------|---------------------------------------|
| Ironworkers:<br>Structural                                     |          | 18.07      |                                       |
| LABO0086-001 05/01/2009                                        |          |            | · · · · ·                             |
|                                                                | Rates    | Fringes    |                                       |
| Laborers:<br>Pipelayer                                         | \$ 18.68 | 6.78       |                                       |
| PLUM0003-005 01/01/2012                                        |          |            |                                       |
| ADAMS, ARAPAHOE, BOULDER, BRO<br>JEFFERSON, LARIMER AND WELD C |          | , DOUGLAS, | · · · · · · · · · · · · · · · · · · · |
|                                                                | Rates    | Fringes    |                                       |
| PLUMBER                                                        |          | 11.44      |                                       |
| PLUM0058-002 07/01/2011                                        |          |            |                                       |
| EL PASO COUNTY                                                 |          |            |                                       |
|                                                                | Rates    | Fringes    |                                       |
| Plumbers and Pipefitters                                       | \$ 32.05 | 12.85      |                                       |
| PLUM0058-008 07/01/2011                                        |          |            |                                       |
| PUEBLO COUNTY                                                  |          |            |                                       |
|                                                                | Rates    | Fringes    |                                       |
| Plumbers and Pipefitters                                       |          | 12.85      |                                       |
| PLUM0145-002 07/01/2011                                        |          |            |                                       |
| MESA COUNTY                                                    |          |            |                                       |
|                                                                | Rates    | Fringes    |                                       |
| Plumbers and Pipefitters                                       |          | 11.05      |                                       |
| PLUM0208-004 01/01/2012                                        |          |            |                                       |
| ADAMS, ARAPAHOE, BOULDER, BRO<br>JEFFERSON, LARIMER AND WELD C |          | , DOUGLAS, |                                       |
|                                                                | Rates    | Fringes    |                                       |
| PIPEFITTER                                                     |          | 11.52      |                                       |
| SHEE0009-002 01/01/2011                                        |          |            |                                       |
|                                                                | Rates    | Fringes    |                                       |
| Sheet metal worker                                             | ¢ 01 CC  | 10.98      |                                       |

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|                                                                          | Rates     | Fringes              |
|--------------------------------------------------------------------------|-----------|----------------------|
| BOILERMAKER                                                              | \$ 17.60  |                      |
| Carpenters:<br>Form Building and Setting.<br>All Other Work              |           | 2.74<br>3.37         |
| Cement Mason/Concrete Finisher.                                          | \$ 17.31  | 2.85                 |
| IRONWORKER, REINFORCING                                                  | \$ 18.83  | 3.90                 |
| Laborers:<br>Common<br>Flagger<br>Landscape                              | \$ 8.91   | 2.92<br>3.80<br>3.21 |
| Painters:<br>Brush, Roller & Spray                                       | \$ 15.81  | 3.26                 |
| Power equipment operators:<br>Backhoe<br>Front End Loader<br>Skid Loader | .\$ 17.24 | 2.48<br>3.23<br>4.41 |
| * TEAM0455-002 07/01/2011                                                |           |                      |
|                                                                          | Rates     | Fringes              |
| Truck drivers:<br>Pickup<br>Tandem/Semi and Water                        |           | 3.87<br>3.87         |

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is union or non-union.

Union Identifiers

An identifier enclosed in dotted lines beginning with characters other than "SU" denotes that the union classification and rate have found to be prevailing for that classification. Example: PLUM0198-005 07/01/2011. The

first four letters , PLUM, indicate the international union and the four-digit number, 0198, that follows indicates the local union number or district council number where applicable , i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2011, following these characters is the effective date of the most current negotiated rate/collective bargaining agreement which would be July 1, 2011 in the above example.

Union prevailing wage rates will be updated to reflect any changes in the collective bargaining agreements governing the rate.

#### Non-Union Identifiers

Classifications listed under an "SU" identifier were derived from survey data by computing average rates and are not union rates; however, the data used in computing these rates may include both union and non-union data. Example: SULA2004-007 5/13/2010. SU indicates the rates are not union rates, LA indicates the State of Louisiana; 2004 is the year of the survey; and 007 is an internal number used in producing the wage determination. A 1993 or later date, 5/13/2010, indicates the classifications and rates under that identifier were issued as a General Wage Determination on that date.

Survey wage rates will remain in effect and will not change until a new survey is conducted.

#### WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- \* an existing published wage determination
- \* a survey underlying a wage determination
- \* a Wage and Hour Division letter setting forth a position on a wage determination matter
- \* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

> Branch of Construction Wage Determinations Wage and Hour Division U.S. Department of Labor 200 Constitution Avenue, N.W. Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an

interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

> Wage and Hour Administrator U.S. Department of Labor 200 Constitution Avenue, N.W. Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board U.S. Department of Labor 200 Constitution Avenue, N.W. Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

END OF GENERAL DECISION

### <u>Career Service Authority</u> Supplemental to the Davis-Bacon HEAVY Construction Projects rates (Specific to the Denver Projects) (Supp #74, Date: 02-03-2012)

| Classification                                                                       |                             | Base    | Fringe  |
|--------------------------------------------------------------------------------------|-----------------------------|---------|---------|
| Millwrights                                                                          |                             | \$28.00 | \$10.00 |
| Line Construction:                                                                   |                             |         |         |
|                                                                                      | Lineman, Gas Fitter/Welder  | \$36.88 | \$9.55  |
|                                                                                      | Line Eq Operator/Line Truck |         |         |
|                                                                                      | Crew                        | \$25.74 | \$8.09  |
| Power Equipment Operators<br>(Tunnels Above and Below<br>Ground, shafts and raises): |                             |         |         |
| · .                                                                                  | GROUP 1                     | \$25.12 | \$10.81 |
| ·                                                                                    | GROUP 2                     | \$25.47 | \$10.85 |
|                                                                                      | GROUP 3                     | \$25.57 | \$10.86 |
|                                                                                      | GROUP 4                     | \$25.82 | \$10.88 |
|                                                                                      | GROUP 5                     | \$25.97 | \$10.90 |
| ······································                                               | GROUP 6                     | \$26.12 | \$10.91 |
|                                                                                      | GROUP 7                     | \$26.37 | \$10.94 |
| Power Equipment Operators:                                                           |                             |         |         |
| · · ·                                                                                | GROUP 1                     | \$22.97 | \$10.60 |
|                                                                                      | GROUP 2                     | \$23.32 | \$10.63 |
|                                                                                      | GROUP 3                     | \$23.67 | \$10.67 |
|                                                                                      | GROUP 4                     | \$23.82 | \$10.68 |
|                                                                                      | GROUP 5                     | \$23.97 | \$10.70 |
|                                                                                      | GROUP 6                     | \$24.12 | \$10.71 |
|                                                                                      | GROUP 7                     | \$24.88 | \$10.79 |
| Ironworkers (Ornamental)                                                             |                             | \$24.80 | \$10.03 |
| Laborers:                                                                            |                             |         |         |
|                                                                                      | GROUP 1                     | \$17.68 | \$8.22  |
|                                                                                      | GROUP 2                     | \$18.18 | \$8.27  |
|                                                                                      | GROUP 3                     | \$21.59 | \$8.61  |
| Laborers: (Tunnel)                                                                   |                             |         |         |
|                                                                                      | GROUP 1                     | \$18.53 | \$8.30  |
|                                                                                      | GROUP 2                     | \$18.63 | \$8.31  |
|                                                                                      | GROUP 3                     | \$19.73 | \$8.42  |
|                                                                                      | GROUP 4                     | \$21.59 | \$8.61  |
|                                                                                      | GROUP 5                     | \$19.68 | \$8.42  |
| Laborers (Removal of Asbestos)                                                       |                             | \$21.03 | \$8.55  |
| Truck Drivers:                                                                       |                             |         |         |
| ·                                                                                    | GROUP 1                     | \$18.42 | \$10.00 |
| ·                                                                                    | GROUP 2                     | \$19.14 | \$10.07 |
|                                                                                      | GROUP 3                     | \$19.48 | \$10.11 |
|                                                                                      | GROUP 4                     | \$20.01 | \$10.16 |
|                                                                                      | GROUP 5                     | \$20.66 | \$10.23 |
|                                                                                      | GROUP 6                     | \$21.46 | \$10.31 |

#### POWER EQUIPMENT OPERATOR CLASSIFICATIONS (TUNNELS ABOVE AND BELOW GROUND, SHAFTS, AND RAISES):

GROUP 1 - Brakeman
GROUP 2 - Motorman
GROUP 3 - Compressor
GROUP 4 - Air Tractors; Grout Machine; Gunnite Machine; Jumbo Form
GROUP 5 - Concrete Placement Pumps; Mucking Machines and Front End Loaders, Underground, Slusher; Mine Hoist Operator; Mechanic
GROUP 6 - Mechanic Welder
GROUP 7 - Mole

NOTE: Any equipment listed below being used in tunnel work, below or above ground shall be paid not less than \$2.00 per hour above the listed wage rates.

#### POWER EQUIPMENT OPERATOR CLASSIFICATIONS:

GROUP 1 - Air compressor, brakeman, drill operator - smaller than Watson 2500 and similar, operators of 5 or more light plants, welding machines, generators, single unit conveyor, pumps, vacuum well point system, tractor, under 70 hp with or without attachments compressors, 360 C.F.M. or less.

GROUP 2 - Conveyor, handling **building** materials, ditch witch and similar trenching machine, haulage motor man, pugmill, portable screening plant with or without a spray bar, screening plants, with classifier.

GROUP 3 - Asphalt screed, asphalt plant, backfiller, bituminous spreader or laydown machine; cableway signalman, caisson drill, William MF, similar or larger; C.M.I. and similar, concrete batching plants, concrete finish machine, concrete gang saw on concrete paving, concrete mixer, less than 1 yd., concrete placement pumps, under 8 inches, distributors, bituminous surfaces dozer, drill, diamond or core, drill rigs, rotary, churn, or cable tool, elevating graders, elevator operator, equipment, lubricating and service engineer, grout machine, gunnite machine, hoist, 1 drum, horizontal directional drill operator, sandblasting machine, single unit protable crusher, with or without washer, tie tamper, wheel mounted, tractor, 70 hp and over with or without attahments, trenching machine operator, winch on truck.

GROUP 4 - Cable operated power shovels, draglines, clamshells, and backhoes, 5 cubic yards and under, concrete mixer over 1 cubic yard, concrete paver 34E or similar, concrete placement pumps, 8 inches and over, grade checker, hoist, 2 drums, hydraulic backhoe, 3/4 yds and over, loader, over 6 cubic yards, mechanic, mixer mobile, multiple unit portable crusher, with or without washer; piledriver, tractor with sideboom, roto- mill and similar, welder.

GROUP 5 - Cable operated power shovels, draglines, clamshells and backhoes over 5 cubic yards, caisson drill Watson 2500 similar or larger, hoist 3 drum or more, mechanic – welder (heavy-duty).

GROUP 6 - Cableway, derrick, quad nine push unit, wheel excavator, belt or elevating loader

GROUP 7 - tower cranes all types

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#### LABORER CLASSIFICATIONS:

GROUP 1 - Janitors; Yardmen

GROUP 2 - including caissons to 8' carrying Reinforcing Rods; Dowel Bars; Fence Erectors; Fire Watchers on power plants and oilrefineries; Gabion Basket and Reno mattresses; Signaling, Metal Mesh; pipe plants and yards; Shrubs and flowers; Stake Caser; Traffic Control Devices; Tie Bars and Chairs in Concrete; Paving; Waterproofing Concrete; Air, Gas, Hydraulic Tools and Electrical Tool Operators; Barco Hammers; Cutting Torches; drill; diamond and core drills; Core, diamond, air track including but not limited to; Joy, Mustang, PR-143, 220 Gardner-**Denver**, Hydrosonic, and water blaster operator; Chuck Tender; Electric hammers; Jackhammers; Hydraulic Jacks; Tampers; Air Tampers; Boring Machines; Air Hydraulic Boring machines; Automatic Concrete Power Curbing

Machines; Concrete Processing Material; form setters; Highways, Streets, and Airports runways; Operators of concrete saws on pavement (other than gangsaws); Power operated Concrete Buggies; Hot Asphalt Labor; Asphalt Curb Machines; Paving Breakers; Transverse Concrete Conveyor Operator; Cofferdams; Boxtenders; Caisson 8' to 12'; Caisson Over 12'; Jackhammer Operators in Caissons over 12'; Labor applicable to Pipe coating or Wrapping; Pipe Wrappers, Plant and Yard; Relining Pipe; Hydroliner (a plastic may be used to waterproof); Pipelayer on Underground Bores; Sewer, Water, Gas, Oil and Telephone Conduit; Enamalers on Pipe, inside and out, Mechanical Grouters; Monitors; Jeep Holiday Detector Men; Pump Operators; Rakers; Vibrators; Hydro- broom, Mixer Man; Gunnite Nozzelmen; Shotcrete Operator; and chain saws, gas and electric; Sand Blaster; Licensed Powdermen; Powdermen and Blaster; Siphons; Signalmen; Dumpman/spotter; Grade Checker.

GROUP 3 - Plug and galleys in dams; Scalers; any work on or off Bridges 40' above the ground performed by Laborers working from a Bos'n Chair, Swing Stage, Life Belt, or Block and Tackle as a safety requirement.

TUNNEL LABORER CLASSIFICATIONS:

GROUP 1 - Outside Laborer - Above ground

GROUP 2 - Minimum Tunnel Laborer, Dry Houseman

GROUP 3 - Cable or Hose Tenders, Chuck Tenders, Concrete Laborers, Dumpmen, Whirley Pump Operators

GROUP 4 - Tenders on Shotcrete, Gunniting and Sand Blasting; Tenders, core and Diamond Drills; Pot Tenders

GROUP 5 - Collapsible Form Movers and Setters; Miners; Machine Men and Bit Grinders; Nippers; Powdermen and Blasters; Reinforcing Steel Setters; Timbermen (steel or wood tunnel support, including the placement of sheeting when required); and all Cutting and Welding that is incidental to the Miner's work; Tunnel Liner Plate Setters; Vibrator Men, Internal and External; Unloading, stopping and starting of Moran Agitator Cars; Diamond

and Core Drill Operators; Shotcrete operator; Gunnite Nozzlemen; Sand Blaster; Pump Concrete Placement Men.

TRUCK DRIVER CLASSIFICATIONS:

GROUP 1 - Sweeper Truck, Flat Rack Single Axle and Manhaul, Shuttle Truck or Bus.

GROUP 2 - Dump Truck Driver to and including 6 cubic yards, Dump Truck Driver over 6 cubic yards to and including 14 cubic yards, Straddle Truck Driver, Liquid and Bulk Tankers Single Axle, Euclid Electric or Similar, Multipurpose Truck Specialty and Hoisting.

GROUP 3 - Truck Driver Snow Plow.

GROUP 4 - Cement Mixer Agitator Truck over 10 cubic yards to and including 15 cubic yards.

WELDERS: Receive rate prescribed for craft performing operation to which welding is incidental.

# CITY AND COUNTY OF DENVER

## STATE OF COLORADO



# **TECHNICAL SPECIFICATIONS**

## **Contract No. 201206436**

## DENVER POLICE DEPARTMENT COMMAND VEHICLE GARAGE

June 6, 2012

**BID DOCUMENTS** 

# PROJECT MANUAL Volume 1 of 1

# DENVER TRAFFIC OPERATIONS COMMAND VEHICLE STORAGE

DENVER, COLORADO

Humphries Poli Architects, P.C. 2100 Downing Street Denver, Colorado 80205 T 303.607.0040 F 303.607.0041 FOR

### DENVER TRAFFIC OPERATIONS **COMMAND VEHICLE STORAGE**

DENVER, Colorado

HPA Project Number 28034.03

#### Owner

Architect

City and County of Denver, Public Works Humphries Poli Architects, PC Denver Police Department 201 W. Colfax, Dept 506 Denver, CO 80202 720.865.2664

#### **Civil Engineers**

HCL Engineering & Surveying 9570 Kingston Court, Ste 310 Englewood, CO 80112 303.773.1605

#### **Structural Engineers**

HCL Engineering & Surveying 9570 Kingston Court, Ste 310 Englewood, CO 80112 303.772.1605

#### Plumbing Engineers

M-E Engineers, Inc. 10055 West 43<sup>rd</sup> Avenue Wheat Ridge, CO 80033 303.421.6655

### 2100 Downing Street Denver, CO 80205 303.607.0040

#### **Mechanical Engineers**

M-E Engineers, Inc. 10055 West 43rd Avenue Wheat Ridge, CO 80033 303.421.6655

#### **Electrical Engineers**

Corey Electrical, LLC 7822 So. Wheeling Court, Ste B Englewood, CO 80204 303.309.6936

#### Security/Technology

**Technology Plus** 2323 S. Troy St. Bldg. 3, Ste. 200 Aurora, CO 80014 303.340.8228 TABLE OF CONTENTS

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#### **DIVISION 1 – GENERAL REQUIREMENTS**

#### SECTION 010100 SUMMARY OF WORK

#### PART 1 - GENERAL

#### 1.01 DESCRIPTION

- A. The Work specified in this contract consists of furnishing all management, supervision, labor, materials, tools, equipment, services, testing and incidentals for the construction of the Work indicated in the contract documents including lump sum items and unit price items.
- B. Reference Contract General Conditions, GC 301, GC 306, GC 804, GC Title 8

#### 1.02 SITE CONDITIONS

- A. The Contractor acknowledges satisfaction as to the nature and location of the Work, all of the general and local conditions, particularly those bearing upon availability of transportation, access to the site, disposal, handling and storage of materials, availability of labor, water, power, roads, and uncertainties of weather, or similar physical conditions at the site, the conformation and conditions of the ground, the character of equipment and facilities needed preliminary to and during work, and all other matters that can in any way affect the work or the cost thereof under this contract.
- B. The Contractor further acknowledges, by submission of a bid and on each change in work proposal, satisfaction as to the character, quality and quantity of all surface and subsurface materials and all features on top of the surface or at worksites that would be encountered from his inspection of the site and from reviewing available records of exploratory work furnished by the City. Failure by the Contractor to become acquainted with the physical conditions of the sites and all the available information will not relieve the Contractor from responsibility for properly estimating the difficulty or cost of performing the Work.
- C. The Contractor warrants that as a result of examination and investigation of all the aforesaid data and the site, that the Contractor can perform the Work in a good and workmanlike manner and to the satisfaction of the City. The City assumes no responsibility for any representations made by any of its officers or agents during or prior to the execution of this contract unless such representation is expressly stated in the contract.

#### PART 2 - PRODUCTS (NOT USED)

#### PART 3 - EXECUTION

#### 3.01 CONTRACTOR'S DUTIES

- A. Except as otherwise specified, furnish the following to the full extent required by the contract:
  - 1. Labor, superintendence, supervision and products.
  - 2. Construction equipment, tools, machinery and materials.
  - 3. Utilities required for construction and related activities.

- 4. Other facilities and services necessary to properly execute and complete the Work, including security for worksite, testing and storage and protection of all materials awaiting incorporation into the Work, providing a safe working environment for workers, City and County of Denver representatives, and the public in accordance with all local, state and federal requirements.
- B. Prosecute the Work as specified and in a timely manner. Submit a schedule of Work that will be performed at times other than during the eight-hour working day of Monday through Friday, daylight hours. Submit this schedule five working days prior to the beginning of Work to the Project Manager for review and acceptance. Approval to work at night may be obtained after Contractor presents a written program outlining special precautions to be taken to control the extraordinary hazards presented by night work. That program shall include, but not limited to, supplementary lighting of work areas, availability of medical facilities, security precautions and noise limitations.

## 3.02 COORDINATION

- A. Coordinate prosecution of the Work with those public utilities, governmental bodies, private utilities and other contractors performing work on and adjacent to the worksites. Eliminate or minimize delays in the Work and conflicts with those utilities, bodies and contractors. Schedule governmental, private utility and public utility work that relies upon survey points, lines and grades established by the Contractor to occur immediately after those points, lines and grades have been established. Confirm coordination measures for each individual case with the City in writing.
- B. In the coordination effort of work by others, the Contractor shall obtain and refer to equipment locations and other layouts, as available, to avoid interface problems.
- C. The City reserves the right to permit access to the site of the Work for the performance of work by other contractors and persons at such times that the City deems proper. The exercise of such reserved right shall in no way or to any extent relieve the Contractor from liability for loss and damage to the work due to or resulting from its operations or from responsibility for complete execution of the Contract. The Contractor shall cooperate with other contractors and persons in all matters requiring common effort.

#### 3.03 CONTRACTOR USE OF WORKSITE

- A. Confine worksite operations to areas permitted by law, ordinances, permits and the contract.
- B. Consider the safety of the Work and that of the people and property on and adjacent to the worksite when determining amount, location, movement and use of materials and equipment on worksite.
- C. Do not load worksite with equipment and products that would interfere with the Work. Only equipment, tools or materials required for this Work may be stored at the worksite.
- D. Protect products, equipment and materials stored on worksite.
- E. Relocate stored products, equipment and materials which interfere with operations of City, government bodies, public and private utilities, and other contractors.

#### PART 4 - MEASUREMENT

#### 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

### PART 5 - PAYMENT

#### 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this section including any and all necessary relocations requested by the City. The cost of the work described in this section shall be included in the Contract price.

#### SECTION 010500 LAYOUT OF WORK AND SURVEYS

#### PART 1 - GENERAL

#### 1.01 SCOPE

- A. This Section covers the procedures and accuracy requirements for survey services for layout of work and field measurement of work quantities to be determined by surveys.
- B. Reference Contract General Conditions, GC 317 and GC 318.

#### 1.02 SUBMITTAL

- A. Refer to Technical Specifications Sections 013000 and 013400 for the submittal process.
  - 1. Copies of original pages of field notes.
  - 2. Original field notebooks when filled and at end of contract.
  - 3. As-built measurements.

#### PART 2 - PRODUCTS (NOT USED)

#### PART 3 - EXECUTION

#### 3.01 CONSTRUCTION LINES AND GRADES

- A. The Contractor shall make surveys and layouts as necessary to delineate the work. The Contractor shall make the surveys for the proper performance of the Work. As a part of such surveys, the Contractor shall furnish, establish and maintain in good order survey control points that may be required for the completion of the Work subject to the approval of the Project Manager as to their location, sufficiency and adequacy. However, such approval by the Project Manager shall not relieve the Contractor of his responsibility for the accuracy of his survey work.
- B. The Contractor shall furnish skilled labor, instrument platforms, ladders and such other temporary structures as may be necessary for making and maintaining points and lines in connection with the surveys required.
- C. The City may draw the Contractor's attention to errors or omissions in lines or grades, but the failure to point out such errors or omissions shall not give the Contractor any right or claim nor shall in any way relieve the Contractor of his obligations according to the terms of this contract.
- D. The Contractor's instruments and other survey equipment shall be accurate, suitable for the surveys required in accordance with recognized professional standards and in proper condition and adjustment at all times. Surveys shall be performed under the direct supervision of a Colorado licensed surveyor.

# 3.02 SURVEYING ACCURACY AND TOLERANCES IN SETTING SURVEY, LAYOUT AND QUANTITY CALCULATION STAKES

A. The tolerances generally applicable in setting survey stakes shall be as set forth in the CDOT Survey Manual, latest edition. Such tolerances shall not supersede stricter toleranc-

es required by the drawings or specifications, and shall not otherwise relieve the Contractor of responsibility for measurements in compliance therewith.

## 3.03 AS-BUILT MEASUREMENTS

A. As-built measurement for items that will be hidden or visible including all civil, mechanical, electrical, control work and all utilities that are placed in concrete, earth or behind walls shall be made Items located within or five feet beyond a building shall be referenced to building column lines and finish floor elevations. Special attention shall be paid to items requiring service, sensors, items with moving parts, access points and locations of junctions, elevation changes and directional changes.

#### PART 4 - MEASUREMENT

#### 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

#### PART 5 - PAYMENT

#### 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

#### SECTION 010600 REGULATORY REQUIREMENTS

#### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. This Section identifies primary compliance with the State, City and County of Denver's regulatory requirements including:
  - 1. Colorado Department of Transportation
  - 2. Department of Public Works (including The Division of Wastewater Management)
- B. Construction shall be based on the latest edition of the referenced codes including additions and revisions thereto that are in effect at the time of project bidding.

#### 1.02 BUILDING CODE

A. All design and construction work shall be governed by the Building Code for the City and County of Denver, latest edition. This is based upon the International Building Code of the International Code Council with Denver Amendments to this code.

#### 1.03 DENVER BUILDING DEPARTMENT

A. For review and approval of all construction documents for compliance to the Denver building code:

City and County of Denver Community Planning and Development Building Inspection Division 201 West Colfax Avenue, Dept 205 Denver, Colorado 80202 Telephone 720-865-2720 Fax 720-865-2880

#### 1.04 DENVER FIRE DEPARTMENT

- For review and approval of plans for compliance with the Denver Fire Department's requirements as they apply to projects for the Department of Public Works: Denver Fire Department 745 W. Colfax Ave. Denver, Colorado 80204 Telephone 720-865-2833
- B. The Contractor is advised that the Denver Fire Department Fire Prevention Bureau requires permitting for the following activities as they apply to the scope of work. The Contractor is responsible for obtaining the appropriate permits necessary to complete the work. All costs associated with this permitting and policy compliance shall be the responsibility of the Contractor. The policies all reference the International Fire Code (IFC).
  - 1. "Hot work", which is defined as the operation of any equipment or tool that creates sparks, hot slag, or radiant or convective heat as a result of the work. This includes, but is not limited to, welding, cutting, brazing, or soldering.
  - 2. Use and storage of compressed gas for both temporary storage and permanent facility installation. This includes, but is not limited to, flammable gas (excluding propane-

- LPG), oxidizer (including oxygen), and inert and/or simple asphyxiates.
- 3. Tank installation, which includes above-ground storage tanks (AST) and underground storage tanks (UST) for both temporary tanks and permanent facility installations.
- C. In addition to the above permits, the Denver Fire Department may require other permits that are associated with the specific work in the Contract Documents. Policies provided by the Denver Fire Department are meant to provide basic information for the most common conditions and situations. In any given occupancy, many other International Fire Code (IFC) requirements may be enforced. These should be addressed with the Denver Fire Department before construction begins and during construction with premise inspection(s). Any questions can be addressed to the Fire Prevention Bureau between 6:30 AM and 9:00 AM Monday-Friday at 720-913-8242 or -8237.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

#### 3.01 PERMITS AND CERTIFICATIONS

- A. The Contractor shall maintain records on site of all permits acquired by federal, state, and local agencies. Posting of permits shall conform to requirements of the respective agencies.
- B. At the completion of any inspection by other agencies, the Contractor shall forward copies of the status of the inspection and copies of any approved or "signed-off" inspections by the respective agencies to the Project Manager.
- C. At the time of request for Substantial Completion, the Contractor shall forward to the Project Manager all permits approved by the respective agencies.

#### PART 4 - MEASUREMENT

## 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

#### PART 5 - PAYMENT

#### 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

#### SECTION 010950 DEFINITIONS AND CONVENTIONS

#### PART 1 - GENERAL

#### 1.01 SUMMARY

A. This Section contains a list of definitions of words or phrases and grammatical or contextual conventions commonly used in these contract documents.

#### 1.02 REFERENCES

A. Related Documents: General Conditions, Special Conditions, and applicable provisions of Technical Specifications Division 1 apply to this Section.

#### 1.03 DEFINITIONS

- A. Alphabetical Listing of Definitions
  - 1. **As indicated:** Shown on the drawings by graphic indication, notes or schedules, or written in the specifications or elsewhere in the contract documents.
  - 2. As directed, as approved, as requested: Unless otherwise indicated, these terms imply "by the Project Manager" and require that an instruction be obtained by the Contractor from the Project Manager.
  - 3. **Concealed:** Embedded in masonry, concrete or other construction; installed in furred spaces; within double partitions or hung ceilings; in trenches; in crawl spaces or in enclosures.
  - 4. **Ensure:** To make certain in a way that eliminates the possibility of error.
  - 5. **Exposed:** Not installed underground or "concealed" as defined above.
  - 6. **Furnish or Provide:** To supply, install and connect complete and ready for safe and regular operation of particular work unless specifically otherwise noted.
  - 7. Indicated, Shown, or Noted: As depicted on drawings or specifications.
  - 8. **Install:** To erect, mount and connect complete with related accessories.
  - 9. **Or equal, or approved equal:** Refers to products which, in the opinion of the Project Manager, are similar in all respects to products specified by proprietary brand name. (Refer to Section 01630 for procedures for submittal of proposed substitutions.)
  - 10. **Rework:** To repair existing items or work required to be removed and replaced in order to accomplish the Work in accordance with the contract documents.
  - 11. **Related Work:** Includes, but not necessarily limited to, mentioned work associated with, or affected by, the work specified.
  - 12. Reviewed, Satisfactory, Accepted, or Directed: Assumes by or to the Project Manager.
  - 13. **Similar, or Equal:** Same in materials, weight, size, design, construction, capacity, performance and efficiency of specified product.
  - 14. **Supply:** To purchase, procure, acquire and deliver complete with related accessories.
  - 15. Unless Otherwise Indicated and Unless Otherwise Noted: General note to perform work as indicated or shown on drawings or in specifications unless specifically

directed otherwise elsewhere in the contract documents; may be abbreviated "U.O.N.", "U.O.I.", or "U.N.O.".

#### 1.04 CONVENTIONS

- A. Specifications Format
  - 1. In order to standardize the location of information in the Contract Documents, the specifications generally are organized in one or more of the following formats:
    - a. The 2004 edition of "MASTERFORMAT" published by the Construction Specifications Institute.
- B. Organization of Drawings and Specifications
  - Organization of the specifications into divisions and sections, and arrangement or numbering of drawings is intended solely for the convenience of the Contractor in his responsibilities to divide the Work among subcontractors or to establish the extent of work to be performed by any trade.
  - 2. Neither the City nor the Project Manager assume any liability arising out of jurisdictional issues or claims advanced by trade organizations or other interested parties based on the arrangement or organization of drawings or specifications.
- C. Gender and Number
  - 1. For convenience and uniformity, parties to the Contract, including the City, Contractor, and Project Manager, and their subcontractors, suppliers, installers, consultants or other interested parties are referred to throughout the contract documents as if masculine in gender and singular in number. Such reference is not intended to limit the meaning of the contract documents to the masculine gender or singular number.
- D. Singular vs. Plural
  - 1. Materials, products, equipment or other items of work referred to in the singular shall be construed as plural where applicable by the intent of the contract documents and shall not limit quantities to be provided by the Contractor.
- E. Imperative Mood
  - 1. Specifications and notes on the drawings or elsewhere in the contract documents are generally written in the imperative mood as instructions to the Contractor, whether the Contractor is specifically addressed or not.
- F. References to Subcontractors or Trades
  - References to subcontractors, trades or other entities which are not parties to the contract shall be construed as meaning the Contractor whose responsibility it shall be to divide the Work among subcontractors or trades. Such references are used as a matter of convention, and are not intended to preclude or direct the Contractor's responsibility to divide the Work.
- G. Abbreviations
  - 1. Abbreviations are believed to be those in general use in the construction industry. Contact the Project Manager for clarification of abbreviations for which the meaning is not clear.

#### PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION (NOT USED)

#### **PART 4 - MEASUREMENT**

#### 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

### PART 5 - PAYMENT

#### 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section.

#### SECTION 011100 CONSTRUCTION SAFETY

#### PART 1 - GENERAL

#### 1.01 WORK INCLUDED

- A. Work specified in this Section includes construction safety precautions and programs by the Contractor and the basis for reviews by the Project Manager.
- B. Reference Contract General Conditions, GC 801 GC 802, GC 803.

#### 1.02 RESPONSIBILITY

- A. The General Conditions make it clear that all safety precautions during the construction process are the responsibility of the Contractor. The Contractor is responsible for the health and safety of his employees, agents, subcontractors and their employees, and other persons on the worksite; for the protection and preservation of the work and all materials and equipment to be incorporated therein; and for the worksite and the area surrounding the worksite. The Contractor shall take all necessary and reasonable precautions and actions to protect all such persons and property.
- B. This Section shall be interpreted in its broadest sense for the protection of persons and property by the Contractor and no action or omission by the Project Manager or his authorized representatives shall relieve the Contractor of any of its obligations and duties hereunder.

## 1.03 SUBMITTAL

A. Refer to Technical Specifications Section 013000 and 013400 for the process. A project specific safety plan shall be submitted by the General Contract prior to commencing any work.

#### 1.04 PROJECT MANAGER'S REVIEW

- A. The Contractor shall provide two (2) copies of its safety program to the Project Manager for review at least ten days before on-site construction begins. The Contractor's program must meet as a minimum all applicable federal, state and local government requirements.
  - 1. The Contractor must, as part of the Contractor's safety program, submit one electronic file in the form of a security-free, fully bookmarked PDF file compatible with Adobe Acrobat 6.0 or newer and one body hard copy of the following information for acceptance by the Project Manager prior to construction:
    - a. Name of the Contractor's site safety representative.
    - b. If the Contractor is running multiple shifts or working more than 40 hours per week, the name of an assistant Contractor's safety representative who can act in the absence of the site safety representative.
    - c. Twenty-four hours per day emergency phone numbers of Contractor site management to be used in case of injury or accident. Provide at least four contacts.
    - d. The Contractor's method of ditching and trenching excavation to be used including how slopes will be stabilized with calculations showing the slope stability. The Contractor shall also show how material will be stored beside the excavation. Stored material will include the excavated and backfilled material.
    - e. How injuries or accidents will be handled including samples of the forms used to report injuries or accidents.

- f. How employees will be handled who are unable to safely perform their duties, including how the Contractor will determine whether an employee is unable to safely perform his duties.
- g. How and when equipment will be checked to see that it is safe, that all safety guards are in place and that the equipment is being used for its designed purpose and within its rated capacity.
- h. How and when all electric devices will be checked for proper grounding and insulation. What system will be used to lock out electric systems that should not be energized.
- i. How trash and human organic waste will be disposed.
- j. How snow and ice will be removed by the Contractor within the project area.
- k. How concrete forms will be anchored to ensure their stability, including calculations showing that the forms will safely hold the maximum construction loads.
- I. How flammable materials will be stored and handled, and how any spills will be cleaned up and removed for disposal.
- m. What system will be used to prevent fires, and if fires do occur who will be trained to fight them. Also what firefighting equipment will the Contractor have available and how will this equipment's condition be monitored.
- n. How materials will be received, unloaded, stored, moved and disposed of.
- o. How personnel working above ground level will be protected from falling.
- p. How people working underneath work will be protected.
- q. What will be done to protect personnel in case of severe weather?
- r. How adequate lighting will be provided and monitored.
- s. How the safety of work platforms, man lifts, material lifts, ladders, shoring, scaffolding, etc. will be ensured relating to load capacity and the protection of personnel using or working around them.
- B. Prior to the start of any work by a contractor or subcontractor employee, the Contractor shall provide the Project Manager with a list of its employees, subcontractor's employees and other personnel the Contractor has requested to work on site, who have signified in writing that they have been briefed on, or have read and understand, the Contractor's Project Specific Safety Plan.

#### PART 2 - PRODUCTS

## 2.01 CONTRACTOR'S PROJECT SPECIFIC SAFETY PLAN

A. Provide a Contractor's Safety Program as described in Part 1 of Technical Specifications Section 011100.

#### **PART 3 - EXECUTION**

#### 3.01 IMPLEMENT CONTRACTOR'S PROJECT SPECIFIC SAFETY PLAN

A. Implement the approved Contractor's Operational Safety Plan as described in Part 1 of this Technical Specifications Section 011100.

## PART 4 - MEASUREMENT

#### 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

## PART 5 - PAYMENT

## 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

#### SECTION 012000 PROJECT MEETINGS

#### PART 1 - GENERAL

#### 1.01 DESCRIPTION

A. The Work specified in this Section requires the Contractor's Project Manager, Superintendent and Quality Control representative to attend meetings scheduled by the City for the collection and dissemination of information related to the subject contract.

#### 1.02 OTHER MEETINGS

A. The Contractor will be advised of times, dates and places of contract meetings.

#### PART 2 - PRODUCTS (NOT USED)

#### **PART 3 - EXECUTION**

#### 3.01 PRECONSTRUCTION MEETING

- A. A Preconstruction Meeting will be scheduled by the City after the Contract has been signed by all parties. The purpose of this meeting is to introduce the City's Representatives to their counterparts in the Contractor's organization and to establish lines of communication between these representatives and outline some contract requirements. The Contractor's Superintendent and Quality Control Representative(s) shall attend this meeting.
- B. The Project Manager will distribute a notice of this meeting, along with an agenda of the subjects to be addressed.
- C. The Project Manager will explain and discuss the responsibilities and authorities of the City, the Designer, and the Project Manager's organization.
- D. The Project Manager will provide highlights of the following information at this meeting:
  - 1. Minority Business Enterprise (MBE) and Women Business Enterprise (WBE) requirements.
  - 2. Insurance, laws, codes, traffic regulations and permit requirements of public agencies and their regulations.
  - 3. Procedures for processing change orders.
  - 4. Procedures for submitting shop and working drawings, product data and samples.
  - 5. Monthly pay estimate cutoff dates.
  - 6. Payment procedures.
  - 7. Request for information procedures.
  - 8. Communication procedures.
  - 9. Contractor-required Daily Report showing the quantitative progress of work, the use of men, material and equipment, problems, potential delays, weather, shift, down equipment, material and equipment received and information received from the City. Daily reports will be submitted to the Project Manager within 48 hours of start of work. Daily Reports are required every day, including weekends and holidays.
  - 10. Scheduling and coordination requirements.
  - 11. Quality control/assurance procedures.

- 12. Environmental requirements and permits.
- 13. As-built documents.
- 14. Project closeout requirements.
- E. The Contractor will introduce the Contractor's representatives and briefly describe each person's responsibilities. The Contractor will provide the following:
  - 1. A list of all subcontractors.
  - 2. Office, storage areas and construction area layouts, along with temporary easements.
  - 3. Safety, first aid, emergency actions and security procedures including the name of the Contractor's insurance company.
  - 4. 60 day preliminary schedule.
  - 5. Sequence of Work.
  - 6. Construction methods and general worksite layout and haul plan.
  - 7. Housekeeping procedures.
  - 8. The Contractor's general erosion and sedimentation control plans, noise, hazardous material, air and water pollution control plans and Quality Control Plan.
  - 9. Coordination and notification for utility work.
  - 10. Deliveries and priorities of major equipment.
  - 11. Submittal Schedule
- F. Explanations provided by the City will not amend, supersede or alter the terms or meaning of any contract document, and the Contractor shall not claim reliance on such explanations as a defense to any breach or failure by the Contractor to perform as specified in the contract.

## 3.02 CONSTRUCTION PROGRESS MEETINGS

- A. Progress meetings will be scheduled weekly and more often as necessary by the Project Manager to promote the competent and timely execution of the contract.
- B. The meetings will be held at the worksite or at a location selected by the Project Manager. Meetings will be chaired by the Contractors Project Manager.
- C. The Contractor's personnel, as listed in Technical Specification Section 012000, 3.01.A, shall attend unless otherwise agreed by the Project Manager.
- D. The Contractors Project Manager will be responsible for publishing minutes of the meetings.
- E. At a minimum, the following items will be addressed at each meeting. The items addressed in the meeting do not waive notification or submittal requirements as required elsewhere in the contract.
  - 1. Safety: Contractor shall report any safety issues
  - 2. Quality Control
    - a. The Contractor's Quality Control Representative shall present and discuss the Independent Testing Agency weekly test report and/or testing schedule.
    - b. The Contractor's Quality Control representative shall report on inspections by other agencies and any follow-up activity required.

- c. The Project Manager will present and discuss issues regarding quality control.
- 3. Quality Assurance
  - a. The Project Manager will present and discuss issues regarding quality assurance.
- 4. Design activities: open discussion
- 5. Shop drawings/submittals/material procurement
  - a. The Contractor shall provide and review the Contractor's submittal schedule and provide any updated information and/or changes to the schedule.
  - b. The Contractor shall provide information on the status of submittals requiring resubmittal.
  - c. The Contractor shall review any accepted submittals that the Contractor plans to re-submit with changes.
  - d. Contract shall provide the status of material procurement for long-lead items (long-lead items are materials and equipment that have a fabrication and/or delivery duration that exceeds 15 working days). This information shall be provided by the Contractor in a format satisfactory to the City Project Manager and shall include, at a minimum: submittal/shop drawing preparation duration, review duration, fabrication duration and a delivery duration. All long-lead items shall be identified with a separate activity on the approved CPM project schedule.
- 6. Construction activities: Open discussion to include coordination items with other Contractors and or agencies.
- 7. Schedule
  - a. The Contractor shall provide to the Project Manager the Contractor's three week look-ahead schedule and review at the meeting the items on the schedule. The schedule shall be in bar chart format based on the approved CPM, and shall include dates of testing activities, items in progress, percentage of completion of items, responsible subcontractor for the items.

#### PART 4 - MEASUREMENT

#### 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

## PART 5 - PAYMENT

#### 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

## **SECTION 012300 - ALTERNATES**

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

#### 1.3 **DEFINITIONS**

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
  - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
  - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

## 1.4 **PROCEDURES**

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
  - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

#### 3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 01: Insulation and Heating at Existing Vehicle Storage Walls and Roof
  - 1. Base Bid: No work associated with the addition of insulation or heating at the Existing Vehicle Storage walls or roof.
  - 2. Alternate: Add Insulation and heating as shown in the Bid Documents for Existing Vehicle Storage
- B. Alternate No. 02: Evidence Cage at Existing Vehicle Storage
  - 1. Base Bid: No work associated with addition of Vehicle Cage 143
  - 2. Alternate: Provide new vehicle cage as depicted in the Bid Documents, including plumbing, electrical, structural, and door modifications and additions.
- C. Alternate No. 3: Install skid-resistant epoxy floor sealer at new garage interior
  - 1. Base Bid: Finish concrete per Concrete specifications.
  - 2. Alternate: All work related to the addition of epoxy floor sealer at new garage interior.
- D. Alternate No. 04: Install Bus Duct
  - 1. Base Bid: Install 400A panel per the Bid Documents
  - 2. Alternate: Eliminate the 400A panel and install bus duct per the Bid Documents.
- E. Alternate No. 05: Provide Solatube Skylights
  - 1. Base Bid: No work associated with skylights
  - 2. Alternate: Provide Solatube Skylights and all associated work per the Bid Documents.
- F. Alternate No. 06: Paint all overhead structure and interior exposed concrete walls and columns.
  - 1. Base Bid: All overhead structure to be primed and interior exposed concrete walls to be finished per associated Concrete and Metals specifications
  - 2. Alternate: Paint all overhead structure and interior exposed concrete walls and columns.
- G. Alternate No. 07: Install interior loops for garage doors
  - 1. Base Bid: No work associated with vehicle loops.
  - 2. Alternate: Install interior loops for garage doors

#### SECTION 013000 SUBMITTALS

#### PART 1 - GENERAL

#### 1.01 DESCRIPTION

- A. The Work specified in this Section summarizes the requirements for the submittal of documents to the City that are defined in these Specifications. It also describes the procedures for "supplemental" submittals.
- B. Reference Contract General Conditions, GC 309 and GC 405.

#### **PART 2 - PRODUCTS**

#### 2.01 SUBMITTAL SCHEDULE

- A. The Contractor shall provide a submittal schedule within 14 days after Notice to Proceed. The Submittal Schedule shall be directly related to the CPM schedule, shall identify all the submittals, and shall include the following information for each submittal item:
  - 1. Specification section, contract article, or special condition
  - 2. Specification Subparagraph
  - 3. Item description
  - 4. Date the submittal shall be submitted
  - 5. Name of subcontractor or supplier
- B. The submittal schedule shall be updated every two weeks by the Contractor and submitted with the progress payment request.
- C. One electronic submittal submitted on a single CD-ROM or DVD-ROM.

#### 2.02 ELECTRONIC SUBMITTALS

- A. All submittals shall be delivered to the Project Manger and Designer in electronic format.
  - 1. Acceptable electronic formats
    - a. Adobe Acrobat 8.0 or newer. All files shall be fully compatible with Adobe Acrobat 8.0. File shall have no security and bookmark every applicable submittal.
  - Formats are acceptable only with written permission of the project manager or required by individual spec sections:
    - a. Microsoft Office 2003 (2007 preferred)or newer. All files shall be fully compatible with Microsoft Office 2003.
    - b. AutoDesk AutoCAD 2007 or newer. All files shall be fully compatible with AutoDesk AutoCAD 2007.
      - 1) AutoCAD files shall be self contained with no external x-references.
    - c. Other files pre-approved by the Project Manager.
  - Electronic file names: Each electronic document shall have a unique file name. File name convention shall be as follows unless otherwise agreed to by Project Manager: -AAA-BBBBB-CCC-RZ
    - a. AAA = sequential submittal number starting at 001.
    - b. BBBBB = specification section containing submittal requirements
    - c. CCC = sequential specification submittal number starting at 001.

- d. RZ = sequential revision number. RZ not required on initial submittals.
- e. Example A:005-013700-002", five submittals have been logged overall with two submittals made to specification section 013700.
- f. Example B: 009-013700-002-R3, nine submittals made overall and three revisions to submittal 013700-002.

### 2.03 INITIAL SUBMITTAL

- A. Each submittal document shall include a title block showing the following information:
  - 1. Date of submittal and revision dates.
  - 2. Contract title and number.
  - 3. The names of Contractor, subcontractor, supplier, manufacturer and when applicable, the seal and signature of an engineer registered in the State of Colorado, for the involved discipline.
  - 4. Identification of product by either description, model number, style number or lot number.
  - 5. Subject identification by contract drawing or specification reference.
- B. On each submitted drawing, include a blank space on each sheet, three inches by four inches, in the lower right corner, just above the title block, in which the City or the Designer of Record may indicate the action taken.
- C. Make submissions sufficiently in advance so that the Designer and City review may be completed before any material procurement or Work represented by those submittals is scheduled to be performed.
- D. Allow a minimum cycle of 10 working days for review of each submittal by the City.
- E. The Contractor shall at the time of submission describe variations from the contract documents in writing, separate from the submittal document. If the Project Manager approves any such variations, an appropriate contract change order shall be issued except that, if the variation is minor and does not involve a change in price or in time of performance, a modification need not be issued. If a submission contains variations and the variation column is not marked on the transmittal form, it will not be considered for review and acceptance. Along with marking the transmittal as a variation, a description must be included which outlines all the differences including maintenance and utility services along with any cost savings from an item not containing the variation.
- F. Changes in accepted submittal documents will not be permitted unless those changes have been accepted, in writing, by the City.
- G. The form and quality of submittal documents shall comply with Technical Specifications Section 013400.

#### 2.04 SUPPLEMENTAL SUBMITTALS

A. Supplemental submittal documents initiated by the Contractor for consideration of corrective procedures shall contain sufficient data for review. Make supplemental submittals in the same manner as initial submittals with the appropriate primary transmittal referenced.

#### **PART 3 - EXECUTION**

#### 3.01 CONTRACTOR'S REVIEW

A. The Contractor shall review submittal documents, stamp and sign as reviewed and approved as complying with contract documents prior to submission to the City.

## 3.02 CITY REVIEW

- A. Submittal documents will be reviewed by the Designer and the Project Manager for conformance to requirements of the contract drawings and specifications. Review of a separate item will not constitute review of an assembly in which the item functions. The Designer or the Project Manager will withhold approval of submittals that depend on other submittals not yet submitted. Review and acceptance will not relieve the Contractor from his responsibility for accuracy of submittals, for conformity of submittal document to requirements of contract drawings and specifications, for compatibility of described product with contiguous products and the rest of the system, or for protection and completion of the contract in accordance with the contract drawings and specifications.
- B. The Designer, and/or the Project Manager will review the submittal documents for general conformance with the contract documents and mark the Action Code, sign and date the transmittal.
- C. The Action Codes have the following meanings:
  - 1. **A ACCEPTED** is an approval, and means that the illustration and description appears to conform to the respective requirements of the contract documents.
  - 2. **B ACCEPTED AS NOTED** is an approval, and means that the illustration and description will conform to the respective requirements of the contract documents after changes in recognition of the reviewer's comments. Submittals so marked need not be resubmitted.
  - 3. **C REVISE AND RESUBMIT** means that the submittal is unacceptable and must be revised and resubmitted.
  - 4. **E NOT ACCEPTED** means that the submittal is not approved and that a new submittal in accordance with the contract documents shall be made.
  - 5. **F RECEIPT ACKNOWLEDGED**, means an item is received by the Project Manager but no review was made. This mark is for use in resubmitting items that were previously Accepted as Noted and the Contractor has incorporated the notes and wants the Project Managers' staff to have the same material that the Contractor's field staff is using.

#### 3.03 CONTRACTOR'S RESPONSIBILITIES

- A. Coordinate each submittal document with the requirements of the Work; place particular emphasis upon ensuring that each submittal of one trade is compatible with other submittals of that trade and submittals of other trades including producing as needed drawings showing the relationship of the work of different trades.
- B. Contractor's responsibility for errors and omissions in submittal documents and associated calculations is not relieved by the City's review, correction and acceptance of submittals.
- C. Contractor's liability to the City, in case of variations in the submittal document from the requirements of the contract documents, is not relieved by the City's review and acceptance of submittals containing variations unless the City expressly approves the deviation in writing, in which the City describes the variation.
- D. The Contractor shall maintain a file of all approved submittal documents at the worksite. The complete file of approved submittal documents shall be turned over to the City with the

as-built documents at the end of the job.

E. Schedule impact due to resubmittal requirements is the responsibility of the Contractor.

## PART 4 - MEASUREMENT

#### 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

#### **PART 5 - PAYMENT**

#### 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

#### SECTION 013100 SCHEDULE

#### PART 1 - GENERAL

#### 1.01 DESCRIPTION

- A. This Section specifies the preparation of a preliminary schedule, construction schedule, related narratives and monthly progress reports, all encompassing complete performance of contract requirements.
- B. The Contractor shall schedule and coordinate the work of all of its subcontractors and suppliers including their use of the worksite. The Contractor shall keep the subcontractors and suppliers informed of the project construction schedule to enable the subcontractors and suppliers to plan and perform their work properly.
- C. The Contractor shall, in accordance with the requirements of the technical specifications, submit a construction schedule that shall provide for the expeditious and practicable execution of the Work.
- D. The construction schedule for the performance of the Work shall be a Critical Path Method (CPM) system in bar chart format, unless an alternate system is specifically identified in the technical specifications, with reasonable detail including a time scaled network and computer printout as more fully detailed in the technical specifications.
- E. Float or slack is defined as the amount of time between the early start date and the late start date or the early finish date and the late finish date of any activities in the schedule. Float or slack is not time for the exclusive use or benefit of either the Contractor or the City.
- F. The Contractor shall submit a monthly progress report and schedule update in accordance with the scheduling provisions of the technical specifications.
- G. The Contractor shall complete the Work within the contract time and in accordance with the most recent schedule submittal that has been approved in writing by the Project Manager.
- H. Reference Contract General Conditions, GC 306, GC 603, GC 909, GC1103, GC 1202

#### 1.02 SUBMITTALS

- A. Refer to Technical Specifications Section 013000 for submittal procedures. Submit the following as indicated:
  - 1. Preliminary schedule (with narrative)
  - 2. Construction schedule data and work plan (with narrative)
  - 3. Monthly progress report
  - 4. Construction schedule change request (as needed)
  - 5. As built construction schedule.

#### PART 2 - PRODUCT

#### 2.01 PLOT AND REPORT FORMAT

A. All plots shall be either 24 x 36 inches or 36 x 44 inches. They shall contain a title block

with a minimum 18-point font showing:

- 1. Contractor's name
- 2. Contract number and title
- 3. Plot date
- 4. Data date
- 5. Symbol definitions
- 6. List of all approved changes to the original approved schedule.
- B. Plots shall contain a time line at the top.
- C. Reports shall be submitted on 8 ½ x 11-inch paper with a one-inch margin in a 3-ring binder, or as directed by the Project Manager.

#### **PART 3 - EXECUTION**

#### 3.01 PRELIMINARY SCHEDULE

- A. The Contractor shall prepare a preliminary schedule covering the first 90 calendar days of the contract. All reports shall be on 8 ½ x 11-inch paper. This preliminary schedule shall be submitted at the Preconstruction Meeting and shall be accompanied by a narrative description of the work plan. Within 14 days, the City will respond with acceptance or direction to revise and resubmit within ten days.
- B. The preliminary schedule shall show all significant work tasks that occur in the first 90 days, including planning, mobilization, shop submittals and approvals, procurement, fabrication and construction. It shall identify work items or milestones that affect or are affected by the City, other Contractor's work, utilities and other third parties, and it shall list major data submittals required by the contract.
- C. The preliminary schedule shall be accompanied by a narrative describing the Contractor's approach to mobilization, procurement and construction during the first 90 days. The narrative shall elaborate on the basis of duration, production rates, major equipment to be used, and shall identify all major assumptions used to develop the schedule.

### 3.02 CONSTRUCTION SCHEDULE

- A. The construction schedule shall be a computerized CPM schedule that includes:
  - 1. Work items identified in a Work Breakdown Structure (WBS) format that corresponds with the technical specifications.
  - 2. The order, sequence and interdependence of all significant work items including construction, procurement, fabrication, testing, startup and inspection and delivery of critical or special materials and equipment, submittals and approvals of critical samples, shop drawings, procedures, or other documents that could have a schedule impact.
  - 3. Work items by the City, other Contractors, utilities and other third parties that may affect or be affected by Contractor's activities.
  - 4. Proper referencing of all work items to identify applicable subcontractors or other performing parties.
  - 5. Work item duration not to exceed 20 working days. No more than 25 percent of the work item may be on the critical path.
  - 6. Work items shall be resource loaded to show the direct craft man-hours estimated to

perform the work including work by subcontractors.

- 7. A narrative that explains the basis for the Contractor's determination of construction logic. It shall include estimated quantities and production rates, hours per shift, work days per week, and types, number and capacities of major construction equipment to be used and whether the Contractor plans to work weekends or holidays.
- B. The construction schedule shall be prepared to include the data for the total contract duration, and the critical path shall be identified, including critical paths for interim completion dates. Scheduled start or completion dates imposed on the schedule by the Contractor shall be consistent with contract milestone dates. Milestone events shall be the schedule dates specified in the Special Conditions and shall be prominently identified and connected to the appropriate work item, denoting its start or completion. Work items related to any interim milestones shall be coded for that milestone.
- C. The Contractor shall submit the following documents to the City upon completion of preparation of the construction schedule:
  - 1. A time phased plot of the CPM schedule in PDM format showing all logic ties and an electronic copy in dynamic format.
  - 2. Various computer generated construction schedule reports that contain the following data for each work item: Identification, description, responsibility, duration, early start and early finish, late start and late finish, total float, and resources. The work items shall be sorted by float, early start, subcontractor or other sorts mutually agreed to. The reports shall also show the logic ties of successor and predecessor work items.
  - 3. A physical progress curve showing either manpower or other appropriate key contract items derived from the construction schedule and against which physical progress performance will be measured for schedule and payment purposes.
  - 4. The narrative described in Technical Specifications Section 013100-3.02.A.7.

#### 3.03 PROGRESS REPORTING

- A. The Contractor shall submit a monthly progress report at the end of each month following the Notice to Proceed. At the end of each month, the Contractor and Project Manager shall agree on the progress of the work and the Contractor shall update the construction schedule accordingly. The updated construction schedule is a prerequisite to the submittal of the Contractor's application for progress payment. The schedule shall be made in accordance with Technical Specifications Section 013100-3.02. This review does not constitute an approval of the construction schedule and shall not be used for the purposes of modifying the initially approved construction schedule.
- B. The Contractor shall submit the monthly progress report consisting of a written narrative and various construction schedule reports. This report will be reviewed in a meeting between the Contractor and Project Manager.
  - 1. The narrative report shall describe overall progress of the work, provide a critical path analysis, discuss significant problems with proposed corrective action, and show the status of major changes and any other changes in sequence of the Work.
  - 2. The construction schedule reports shall include tabular reports showing the status of resources for completed and in progress work items and for work items scheduled to start in the next 30 days. The report shall include all the information outlined in Technical Specifications Section 013100-3.02.C.2.
  - 3. A bar chart format schedule shall be provided showing the Contractor's completion status (progress) on each work item along with plots described in Technical Specifica-

tions Section 013100-3.02.C.1.

- 4. The physical progress curve shall be updated to show actual progress.
- C. The latest completion time for any work item does not fall within the time allowed by the construction schedule, the sequence of work and/or duration shall be revised by the Contractor through concurrent operations, additional manpower, additional shifts or overtime, additional equipment or alternative construction methods until the schedule produced indicates that all significant contract completion dates, occupancy dates and milestones will be met. No additional costs will be allowed if such expediting measures are necessary to meet the agreed completion date or dates except as provided elsewhere in the contract documents.

#### 3.04 SCHEDULE CHANGES

- A. The Contractor's request for construction schedule changes shall be made on the latest approved construction schedule and shall be accompanied by a narrative description and justification for the change, and shall be submitted in accordance with the General Conditions Title 1105 on changes in time. Minor revisions submitted at monthly progress review meetings are not considered as changes in this context.
- B. The construction schedule may be changed when one or more of the following occur:
  - 1. When a change order significantly affects the contract completion date or sequence of work items.
  - 2. When the Contractor elects to change the sequence or duration of work items affecting the critical path.
  - 3. When the City directs a change that affects a milestone date(s) specified in the Special Conditions or alters the length of a critical path.
- C. If, after submitting a request for change to the construction schedule, the Project Manager does not agree with the request, the Project Manager will schedule a meeting with the Contractor to discuss the differences. If a settlement cannot be reached on the change in the construction schedule or if the Contractor has failed to submit revisions to the network, the Project Manager has the option of providing suggested logic and/or duration times in all subsequent updating reports. The suggested logic and/or duration times will remain in effect until the change in the construction schedule is settled or until the logic and duration are superseded.
  - 1. If the Contractor has any objections to the data furnished by the Project Manager, he shall advise the Project Manager within ten days in writing, fully supporting the objections with a counter plan. The revisions suggested by the Project Manager shall be used for updating reports until the Project Manager approves the counter plan.
  - 2. If the Contractor does not submit a counter plan and data within ten days after the date of the Project Manager's suggested logic, the Contractor is deemed to concur with the Project Manager's suggested logic/duration time changes. The Project Manager's plan will be the basis of negotiations for any adjustment of the time and cost for performance of the Work.

#### 3.05 CONTRACT EXTENSIONS

A. If the Contractor is granted an extension of time for completion of any milestone or contract completion date under the provisions of the contract, the determination of the total number of extended days will be based upon the current analysis of the schedule and upon all data relevant to the extension. Such data shall be incorporated in the next monthly update of the

schedule.

B. The Contractor acknowledges and agrees that delays in work items which, according to schedule analysis do not affect any milestone dates or contract completion date shown on the CPM network at the time of the delay will not be the basis for a contract extension.

## 3.06 AS-BUILT CONSTRUCTION SCHEDULE

A. After all contract work items are complete, the Contractor shall submit an as built construction schedule showing actual start and finish dates for all work items and milestones.

## **PART 4 - MEASUREMENT**

#### 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

#### PART 5 - PAYMENT

#### 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

## SECTION 013400 SHOP AND WORKING DRAWINGS, PRODUCT DATA AND SAMPLES

#### PART 1 - GENERAL

#### 1.01 DESCRIPTION

- A. The Work specified in this Section consists of preparing and submitting shop and working drawings, product data, samples and record documents required by other technical specifications sections.
  - 1. The Contractor shall submit all shop drawings, working drawings, product data and samples, as defined in Title 1 of the General Conditions, to the Designer and Project Manager in accordance with the requirements in the technical specifications. The Project Manager will return one copy of the shop drawings, working drawings and product data to the Contractor with a written transmittal within the time periods noted in the technical specifications.
- B. Reference Contract General Conditions, GC 110, GC 117, GC 405.

#### 1.02 SUBMITTALS

- A. Refer to Technical Specifications Section 013000 for submittal procedures.
- B. All submittals shall be delivered to the Designer and Project Manager in electronic format. All submittals must be of a consistent format (all Acrobat or all Word, etc). No combination of electronic file types will be allowed unless required by a specific specification section..
  - 1. Acceptable electronic formats
    - a. Adobe Acrobat 8.0 or newer. All files shall be fully compatible with Adobe Acrobat 8.0
    - b. Formats are acceptable only with written permission of the Project Manager or required by individual spec sections:
      - 1) Microsoft Office 2003 (2007 preferred) or newer. All files shall be fully compatible with Microsoft Office 2003.
      - 2) AutoDesk AutoCAD 2007 or newer. All files shall be fully compatible with AutoDesk AutoCAD 2007.
        - a) AutoCAD files shall be self contained with no external x-references.
      - 3) Other files pre-approved by the Project Manager
  - 2. Adobe Acrobat Requirements:
    - a. Drawings shall have security set to "No Security". Commenting, printing, adding photos, form fields and document signing must be allowed.
    - b. PDF submittals shall be one continuous file. No external links are allowed.
    - c. All individual components of submittals shall be bookmarked inside the PDF file.
    - d. All original documents shall be directly converted from the original electronic format to PDF. Scanning of files shall only be allowed by the Project Manager when the original electronic information is not obtainable.
    - e. Failure to comply with these requirements will result in a return of file to the Contractor for immediate revision.
  - 1. Electronic file names: Each electronic document shall have a unique file name. File name convention shall be as follows unless otherwise agreed to by Project Manager: AAA-BBBBB-CCC-RZ
    - a. AAA = sequential submittal number starting at 001.

- b. BBBBB = specification section containing submittal requirements
- c. CCC = sequential specification submittal number starting at 001.
- d. RZ = sequential revision number. RZ not required on initial submittals.
- e. Example A:005-013700-002", five submittals have been logged overall with two submittals made to specification section 013700.
- f. Example B: 009-013700-002-R3, nine submittals made overall and three revisions to submittal 013700-002.

#### C. Quantities

- 1. Post electronic submittals as PDF electronic files directly to Designer's FTP, Contractors FTP site or a site specifically established for the Project.
  - a. The Contractor should send an email for each submittal posted to all parties notifying them the submittal is available for review.
  - b. The Project Manager or Designer will send an email to the Contractor when the submittal review is complete.
- 2. Contractor can submit electronic submittals via email as PDF electronic files if approved by the Project Manager.
- 3. Four samples of each item specified in the various specification sections, unless otherwise specified.
- 4. Note: If manufacturer's printed information is in color, all copies of submittals must be in color.
  - a. Printed information is only allowed when electronic copies are not possible.
- D. Review
  - 1. Submittal review comments by the City and the Designer will be in electronic form and incorporated into the electronic submittal file.
  - 2. Resubmittals of electronic documents shall modify the original electronic file with new information and include the City and the Designer's comments with appropriate responses and additional information.

## 1.03 CHANGES

A. Changes in products for which shop or working drawings, product data or samples have been submitted will not be permitted unless those changes have been accepted and approved in writing by the City and County of Denver.

## PART 2 - PRODUCTS

#### 2.01 SHOP AND WORKING DRAWINGS

- A. Include the following as they apply to the subject:
  - 1. Contract title, work order and number.
  - 2. Respective contract drawing numbers.
  - 3. Applicable specification section numbers.
  - 4. Relation to adjacent structure or materials.
  - 5. Field dimensions clearly identified as such.
  - 6. Applicable standards such as ASTM or Federal Specification number, and pertinent authority specifications or standards.

- 7. Identification of deviations from the contract drawings and specifications.
- 8. Drawing name, number and revision.
- 9. Contractor's stamp, initialed or signed, certifying:
  - a. Verification of field measurements.
    - b. Review of submittals for compliance with contract requirements.
    - c. Compatibility of the Work shown thereon with that of affected trades.
- 10. Blank space on each sheet per Technical Specifications Section 01300, paragraph 2.02.B.
- B. Drawings of equipment and other items that contain multiple parts shall include exploded views showing the relationship of parts and the description of the parts into the smallest units that may be purchased or serviced.

#### 2.02 PRODUCT DATA

- A. Modify manufacturer's standard and/or schematic drawings to delete information which is not applicable to the contract. Supplement standard information with additional information applicable to this contract.
- B. Modify manufacturer's standard(s), diagrams, schedules, performance charts, illustrations, calculations and other descriptive data to delete information which is not applicable to the contract. Indicate dimensions, clearances, performance characteristics and capacities. Include with the submittal electrical, plumbing, HVAC and any other diagrams, as applicable.
- C. Modify erection, application and placing instructions to delete information that is not applicable to the contract or work order.
- D. Include the following:
  - 1. Contract title, work order and number
  - 2. Respective contract drawing numbers
  - 3. Applicable contract technical specification section numbers
  - 4. Applicable standards such as ASTM or Federal Specification number, and pertinent authority specification or standards
  - 5. Identification of deviations from the contract drawings and specifications
  - 6. Contractor's stamp, initialed or signed, certifying:
    - a. Dimensional compatibility of the product with the space in which it is intended to be used
    - b. Review of submittals for compliance with contract requirements
    - c. Compatibility of the product with other products with which it is to perform or which will be next to it.
    - d. The products electrical, plumbing, control and HVAC requirements conform to contract documents and the necessary utilities are provided for in the contract documents.
- E. Certificates of compliance shall be submitted for all products. The certificates shall:
  - 1. State that the product complies with the respective specification and contract drawing requirements
  - 2. Be accompanied by a certified copy of test results pertaining to the product

- 3. Show the submittals date, Contractor's name and address, contract title and number, product represented and its location in the contract, producer's name, product trade name and catalog number, place of product origin, test date, testing organization's name and address, quantity of the product to be furnished and related contract drawing and specification section numbers
- 4. Be signed by an officer or another authorized representative of the producer and notarized
- 5. Submit one electronic copy.
- 6. Be received by the City not later than 30 days before the acceptance is needed of the products for ordering.

#### 2.03 SAMPLES

- A. Submit samples of sizes and quantities to clearly illustrate full color range and functional characteristics of products and materials including attachment devices.
- B. Erect field samples and mock ups at the worksite as specified in the several technical specifications sections and at locations acceptable to the Project Manager. All field samples shall be erected in a location that will be readily visible throughout the life of the contract to allow comparison of the work as it progresses to the field sample.
- C. The Contractor shall verify, through appropriate inspections and tests, that the samples submitted meet the specifications and shall provide inspection and test data with the samples. The review and comments on the sample shall not relieve the Contractor of his responsibility for completion of the contract.
- D. Show the following information:
  - 1. Contract title and number
  - 2. Respective contract drawing numbers
  - 3. Applicable technical specification section numbers
  - 4. Applicable standards such as ASTM or Federal Specification number
  - 5. Identification of deviations from the contract drawings and specifications
  - 6. Contractor's stamp, initialed or signed, certifying:
    - a. Dimensional compatibility of the product with the space in which it is intended to be used
    - b. Review of submittals for compliance with contract requirements
    - c. Compatibility of the product with other products with which it is to perform or which will be next to it
  - 7. If multiple samples are submitted and the Project Manager is requested to make a choice, each sample shall have a unique identification number attached to it so the returned transmittal can state the identification number of the accepted sample and the Contractor will know which one it is.

#### **PART 3 - EXECUTION**

#### 3.01 CONTRACTOR RESPONSIBILITIES

- A. Verify field measurements, catalog numbers and similar data.
- B. The Contractor shall not start work for which submittals are required until a transmittal has

been received by the Contractor showing acceptance or acceptance as noted by the Project Manager.

- C. Before making submittals ensure that products will be available in the quantities and at the times required by the contract.
- D. Submit final, corrected, electronic drawings of contract and shop and working drawings showing the Work as actually installed, placed, erected and applied. Refer to Technical Specification Section 01700, Contract Closeout.

#### 3.02 REVIEW BY THE CITY

- A. One electronic copy of the marked-up shop and working drawing and one electronic copy of the product data will be returned to the Contractor by the Project Manager. Only the transmittal form, appropriately marked, and two samples will be returned on sample submittals. Contractor shall maintain one approved sample onsite for the duration of the project.
- B. Contractor's responsibility for errors and omissions in submittals for compatibility will not be reduced, waived or otherwise limited by the review and acceptance of submittals by the City.

#### PART 4 - MEASUREMENT

#### 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

#### **PART 5 - PAYMENT**

#### 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract Price.

## SECTION 013700 SCHEDULE OF VALUES

#### PART 1 - GENERAL

#### 1.01 DESCRIPTION

- A. The Work specified in this Section consists of preparing and submitting the Schedule of Values ("Schedule") as referenced in the General Conditions. The Schedule will be built upon a breakdown of the Work using specification sections and milestones. The Work also includes the preparing and submitting of updated copies of the Schedule if the Schedule is affected by change orders.
- B. A Schedule of Stored Material is a detailed cost breakdown for permanent materials that will be temporarily stored prior to their being installed and for which the Contractor seeks partial payments. The Schedule of Stored Material will be incorporated as a part of the Schedule of Values.
- C. Within 14 calendar days of issuance of the Notice to Proceed, the Contractor shall submit the Schedule of Values including the Schedule of Stored Material if applicable. The Schedule of Values and Schedule of Stored Material used to prepare the work/cost breakdown for the Schedule will be used for the Contractor's billings.
- D. Any contract allowances shall be included in the Schedule. Expenditure of allowances shall be done through the use of the Allowance Authorization form. Use of this form does not increase or decrease the contract value.
- E. Reference Contract General Conditions, GC 902, GC 903 and GC 906.

### 1.02 RELATED DOCUMENTS

- A. Technical Specifications Section 013000 Submittals
- B. Technical Specifications Section 013400 Shop and Working Drawings, Product Data and Samples
- C. Technical Specifications Section 019990 Standard Forms

#### 1.03 SUBMITTAL

- A. The Schedule shall be submitted in a format approved by the Project Manager.
- B. The Schedule shall identify each item of work. Work items in the Schedule shall represent all work and shall be referenced with the Technical Specifications section numbers, specification subparagraph, specification section title and the bid item number used for the Schedule of Prices and Quantities when applicable. The Schedule shall address the subcontractor, fabricator or supplier furnishing the materials and or labor for each work item.
- C. Upon request by the City, the Contractor shall support values given with the data which will substantiate the correctness of the values.
- D. The Schedule will be utilized only as a basis for review of the Contractor's application for progress payment.

## 1.04 REVIEW AND RESUBMITTAL

A. If review by the City indicates that changes to the Schedule are required, the Contractor shall revise and resubmit the Schedule.

## PART 2 - PRODUCTS (NOT USED)

### PART 3 - EXECUTION

## 3.01 PREPARING SCHEDULE OF VALUES

- A. Breakdown of the items used in the Schedule shall include costs as follows:
  - 1. Delivered cost of product with applicable taxes paid
  - 2. Total installation cost with overhead and profit
  - 3. Breakdown costs of each lump sum item with a list of products and major operations for which the Contractor seeks to receive progress payments to recover his costs for that bid Item
  - 4. Each unit price item as listed in the bid Schedule of Prices and Quantities shall list products and major operations for which the Contractor seeks to receive progress payments for that bid item.

# 3.02 PREPARING SCHEDULE OF STORED MATERIAL

- A. The Contractor shall submit with the Schedule an indication of whether products will be stored on or off the worksite. The Schedule of Stored Material shall show quantities and types of products that will be stored.
- B. Material allowances consist of only the net cost of the product, the cost of delivery and unloading at the storage site, the cost of applicable sales taxes and all discounts.
- C. In no case will the cost paid for a permanent material be greater than 90 percent of the contract price for the work in which they are included.

### 3.03 PAYMENT FOR STORED MATERIALS

- A. Only materials that are described in the specifications and on the drawings will be considered permanent materials. Permanent materials are materials that will be left in the work after the contract is completed.
- B. Nothing in these specifications shall be interpreted as requiring the City to pay for stored materials. The Project Manager shall decide on a case-by-case basis whether stored materials shall be paid for. No payment will be made for stored materials which have not been submitted and accepted.
- C. The Contractor must, at all times, store permanent materials in accordance with manufacturer's recommendations. Any material not properly stored will not be paid for. Amounts will be deducted from payments for any stored permanent material previously paid for and subsequently found to be improperly stored or not present, based upon a physical inventory of stored permanent material.
- D. Only the neat line quantity of material needed for the finished product may be paid for.
- E. All requests for stored permanent material payment must be accompanied by paid invoices clearly showing the quantity of permanent material, the type of permanent material and discounts or rebates and the net amount paid to the supplier along with a certificate stating that the permanent material is free of any liens or judgments preventing its use by the City.

- F. All permanent material stored off site, for which payment is being requested must be insured and stored in bonded, insured warehouses.
- G. Any permanent material on which payment is requested must be in such a form that it cannot be used on work other than this contract, or stored in a manner acceptable to the Project Manager to ensure that the permanent material cannot be used on work other than this contract.

## 3.04 ALLOWANCE AUTHORIZATION AND PAYMENT

- A. Contractor shall request written approval for expenditure of any contract allowances PRIOR TO performing the Work involved. List work to be performed and estimated cost in the requesting correspondence.
- B. Original copies of all invoices and receipts must be submitted with the Allowance Authorization as part of the request for payment.
- C. Using the format provided by the City, the Contractor's request for payment of all contract allowances shall be included in the Schedule of Values.

## PART 4 - MEASUREMENT

### 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

## PART 5 - PAYMENT

# 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract Price.

## SECTION 014000 CONTRACTOR QUALITY CONTROL

#### PART 1 - GENERAL

#### 1.01 DESCRIPTION

- A. This Section identifies the Quality Control activities to be performed during all phases of the contract by the Contractor.
- B. The Contractor shall have in place his Project Specific Quality Control Program as necessary to ensure that all materials and work are completed in compliance with contract documents. The Contractor is solely responsible for Quality Control with the exception of those tests and/or audits that will be conducted by the City as defined in the contract documents.
- C. Test schedules and/or testing requirements for materials used on this project are included in the technical specifications. Laboratory and field testing identified in the technical specifications shall be conducted by an Independent Testing Agency (ITA) retained by the City.

#### 1.02 LEVEL OF CONTROL

- A. The intent of this section is to enable the Contractor to establish a necessary level of control that will:
  - 1. Adequately provide for the production of acceptable quality materials
  - 2. Provide sufficient information to ensure both the Contractor and the Project Manager that the specification requirements are being met
  - 3. Allow the Contractor as much latitude as possible to develop his or her own standards of control.

#### 1.03 SUBMITTALS

- A. Refer to Technical Specification Section 013000 and Technical Specifications Section 013400, and Technical Specification 014000 Quality Assurance for submittal requirements.
- B. Quality Control Plan: Within 10 days after Notice to Proceed, the Contractor shall submit a Quality Control Plan for review and acceptance. Acceptance by the Project Manager does not relieve the Contractor of compliance with the contract requirements. The Contractor Quality Control Plan shall address the following as a minimum:
  - 1. Provide a general description of Quality Control monitoring to be performed until final acceptance by the City. Include monitoring activities of Work and the worksite during times no construction activity is scheduled to take place.
  - 2. The Contractor shall designate an employee as the Quality Control Manager qualified to perform quality control monitoring of the Work. The designated individual shall have the authority to direct work changes required to bring the Work into conformance with contract requirements including stopping non-conforming work in progress.
  - 3. The Quality Control Plan shall address each technical specification division's requirements for quality control. The Contractor shall identify each item requiring submittal and approval/acceptance prior to installation of work. Also, the Contractor shall identify each item of work requiring testing by the independent testing agency.
  - 4. The Quality Control Plan shall address and establish controls and documentation format to ensure that items or materials that have been accepted through receiving inspection are used or installed. Identification and traceability shall be provided

throughout all inspections, test activities and records. For stored items, provisions shall be made for the control of item/material identification, consistent with the expected duration and type of storage.

- 5. Provide methodology of monitoring, testing and exercising of all equipment, valves and/or assemblies to ensure the Work installed is in proper working order.
- 6. The Contractor shall submit a list of suppliers and subcontractors. This list shall include items to be supplied by each supplier and/or subcontractor and shall identify work to be performed by each subcontractor. The list shall be updated and resubmitted as required.
- 7. Provide emergency contact information including name, company, title, work phone number, home phone number and other means of contact. The Emergency Contact list shall include at least four individuals. The Emergency Contact list shall be maintained on a daily basis. In the event there is any change in any of the information, the Contractor shall forward the updated list to the Project Manager. The Emergency Contact list shall include the project number, project title and date of issue.
- C. Daily Quality Control Report:
  - The Daily Quality Control Report shall be submitted daily in the format detailed in Technical Specifications Section 019990. The report shall address as a minimum the following: identify number of workers on site each day by trade, identify notifications and discussions with/by DIA Quality Assurance Inspectors and other agency inspectors, identify quality of work placed that day and any deviations and/or corrections required to bring the Work into conformance with the contract. Daily reporting may be computerized or typed, but must contain an electronic signature. Legible, hand written reports on the approved form shall be accepted. Scanned copies of daily reports are acceptable.
  - 2. Submit one electronic copy of the Daily Quality Control Report to the Project Manager the day following the work. The report shall be signed by the Contractor's Quality Control Representative and the Contractor's Superintendent.
- D. Corrective Action Report (CAR)
  - 1. Conditions adverse to quality will be reviewed by the Contractor to determine the cause and to recommend a corrective action that will preclude recurrence. The condition, its cause and the corrective action planned shall be reported to the Project Manager prior to implementation. Follow-up action shall be taken to verify implementation of the corrective action. The Contractor will document the corrective action and a copy of the Corrective Action Report (CAR) will be transmitted to the Project Manager.

# 1.04 DOCUMENTATION

- A. The Contractor shall not change or alter approved submittals, procedures, specifications, drawings or other pertinent documentation without the Project Manager's written authorization.
- B. All records and documents that are quality related shall be prepared, identified and maintained by the Contractor and shall be made available to the City upon request. Records shall be protected from damage, deterioration or loss. A copy of the records and documents shall be maintained at the Work site at all times unless the Project Manager has approved other locations in writing. Retention time for all quality records shall be not less than three years from date of Final Acceptance of the contract.
- C. The Contractor shall maintain records at the actual worksite and at Contractor's office to

show the inspection status of materials and items installed in order to ensure that the required inspections and tests have been performed in a timely and correct manner.

# 1.05 INSPECTIONS AND TESTS

- A. Inspections, tests and system shut down requests, conducted by persons or agencies other than the Contractor, shall not in any way relieve the Contractor of his responsibility and obligation to meet all specifications and the referenced standards. The Contractor's designated Quality Control Representative shall inspect the work and shall ensure the work complies with the contract requirements prior to any requests for inspection or testing.
- B. When the specifications, laws, ordinances, rules, regulations or orders of any public agency having jurisdiction require the Project Manager's surveillance of inspections or tests, the Contractor shall notify the Project Manager of the place, date and time 48 hours prior to the inspection and/or test. The Contractor shall be responsible for notifying and requesting inspection by other agencies including but not limited to the Denver Building Inspection Division, Denver Fire Department and Denver Water Department. Prior to request for other agency inspections, the Contractor shall meet and plan inspection times with the Project Manager and or the Project Manager's designated representative.
- C. Special inspections or tests may be required by the technical specifications, City, State and/or Federal Agencies in addition to those tests already performed. The Contractor shall notify the Project Manager at least 48 hours in advance of the additional inspections or tests.

## 1.06 INSPECTION PLAN

- A. The Contractor shall utilize the following six-point inspection plan to ensure the conformance of the Work performed by the Contractor meets the requirements of the contract drawings and specifications, the referenced codes and standards and the approved submittals:
  - Prework Coordination: Prior to the start of construction work on the contract and prior to the start of work under each separate specification section and prior to the start of work where a change in a construction operation is contemplated by the Contractor and prior to a new subcontractor starting work, a coordination meeting will be held with the Contractor's superintendent, Quality Control and Safety representative(s), and the ITA representative,. Supervisory, Safety and Quality Control, representatives of all applicable subcontractors will also attend. The Contractor's Quality Control Representative shall chair, prepare and distribute minutes of Quality Control meetings. Meeting minutes shall be electronically distributed within 24 hours of the meeting.
  - 2. The purpose of the meeting is to ensure that the Contractor's personnel have no misunderstandings regarding their safety and quality procedures as well as the technical requirements of the contract. The following items shall be presented and reviewed by the Contractor:
    - a. Contract requirements and specifications
    - b. Shop drawings, certifications, submittals and as-built drawings
    - c. Testing and inspection program and procedures
    - d. Contractor's Project Specific Quality Control Program
    - e. Familiarity and proficiency of the Contractor's and subcontractor's workforce to perform the operation to required workmanship standards including certifications of installers
    - f. Safety, security and environmental precautions to be observed
    - g. Any other preparatory steps dependent upon the particular operation

- h. The Contractor's means and methods for performing the Work.
- 3. Initial Inspection: Upon completion of a representative sample of a given feature of the Work and no later than two weeks after the start of a new or changed operation, the Project Manager and/or the Project Manager's designated representatives will meet with the Contractor's Quality Control representative and applicable subcontractor's supervisor and their Quality Control representatives to check the following items, as a minimum:
  - a. Workmanship to established quality standards
  - b. Conformance to contract drawings, specifications and the accepted shop drawings
  - c. Adequacy of materials and articles utilized
  - d. Results of inspection and testing methods
  - e. Adequacy of as-built drawings maintained daily.
- 4. Once accepted, the representative sample will become the physical baseline by which ongoing work is compared for quality and acceptability. To the maximum practical extent, approved representative samples of work elements shall remain visible until all work in the appropriate category is complete. Acceptance of a sample does not waive or alter any contract requirements or show acceptance of any deviation from the contract not approved in writing by the Project Manager.
- 5. Follow-up Inspection: The Contractor's Quality Control representative will monitor the work to review the continuing conformance of the work to the workmanship standards established during the preparatory and initial inspections.
- 6. Completion Inspection: Forty-eight hours prior to the completion of an item or segment of work and prior to covering up any work, the Contractor will notify the Project Manager who will verify that the segment of work is substantially complete, all inspections and tests have been completed and the results are acceptable. The purpose of this inspection is to allow further corrective work upon, or integral to, the completed segment of work. THIS IS NOT AN ACCEPTANCE INSPECTION. If any items are determined to be deficient, need correction or are non-conforming, a Deficiency List will be prepared and issued to the respective Contractor for correction, repair or replacement of any deficient or non-conforming items. The Project Manager and Contractor's Quality Control representative will verify the correction of the deficient and/or non-conforming items prior to the start of the next operation.
- 7. Pre-Final Acceptance Inspection: Prior to requesting a Pre-Final Acceptance Inspection by the City, all work and operational systems to be inspected shall be satisfactorily completed and tested by the Contractor. The Contractor's written request for this inspection shall be made 72 hours in advance. With the request shall come a list of any known deficiencies and when they will be corrected. If the list is too large or contains too many significant items, in the opinion of the Project Manager, no inspection will be held because of the incompleteness of the work.
- 8. The Project Manager will schedule the Pre-Final Acceptance Inspection and will prepare a list of deficient items (punch list) discovered during the inspection. If during the inspection the list becomes too large or too many significant items are on the list, the inspection will be canceled. After the inspection is completed, the Deficiency List will be transmitted to the Contractor for correction of the deficient items.
- 9. Final Acceptance Inspection: After the Contractor has completed all items on the Deficiency List (generated from the Pre-Final Acceptance Inspection) he shall request a Final Acceptance Inspection. The request shall be made in writing at least 72 hours in advance of the inspection. All areas must be cleaned and ready for turnover prior to this inspection. The Project Manager, the design consultant, a representative of the funding agency (if applicable) and other interested parties will inspect the subject

Work to ensure that all deficiencies have been satisfactorily attended to and that no new deficiencies have appeared and that all systems are completely functional. Any outstanding or additional deficient items will be noted and handled per the requirements of the Pre-Final Acceptance Inspection noted above until the Work is acceptable to the Project Manager.

## 1.07 SAMPLES

- A. The Contractor shall maintain at the worksite a copy of all samples submitted and accepted by the City. Samples shall be made available to the designer or the Project Manager's designated representatives for review and comparison in the field. The Project Manager prior to use on the project must accept all items and materials.
- B. The installed work will be compared to the samples and if any of the work is not of the same quality, material, finish, color, texture or appearance as the sample, that portion that is not the same will be considered defective and in nonconformance.
- C. Contractor selection of samples will only be considered if taken at random. The Contractor shall permit representatives of the City to witness the selection of samples. Inspection or tests of items or materials that fail shall be sufficient cause to terminate further inspections/tests of the same brand, make or source of that product.
- D. The Contractor is obligated to correct any item deemed deficient.

## PART 2 - PRODUCTS (NOT USED)

## **PART 3 - EXECUTION**

## 3.01 REQUIREMENTS

- A. All materials required for the contract shall be new except where specified otherwise. The Project Manager may elect to perform additional inspections and/or tests at the place of the manufacture, the shipping point or at the destination to verify conformance to applicable specifications. Inspections and tests performed by the City shall not relieve the Contractor from the responsibility to meet the specifications, nor shall such inspections/tests be considered a guarantee for acceptance of materials that will be delivered at a later time.
- B. The Contractor is obligated to correct or remove non-conforming materials, whether in place or not. If necessary, the Project Manager will send written notification to the Contractor to correct or remove the defective materials from the project. If the Contractor fails to respond, the Project Manager may order correction, removal and/or replacement of defective materials by others, in which case the Contractor shall bear all costs incurred by such actions.
- C. Materials accepted on the basis of a Certificate of Compliance may be sampled and inspected/tested by the City Project Manager or its Designer at any time. The fact that the materials were accepted on the basis of such certification shall not relieve the Contractor of his responsibility to use materials that conform to the specifications.
- D. The Contractor shall impose upon his suppliers the same quality control requirements, including inspection and test procedures, as imposed upon him by the specifications and referenced standards. The Contractor shall apply appropriate controls, designed to ensure that all materials supplied meet the requirements and specifications.

# PART 4 - MEASUREMENT

### 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

# PART 5 - PAYMENT

### 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract Price. If the City is required to reinspect work or conduct a special test because a previous inspection, requested by the Contractor, showed that the work was defective or not in conformance, the Manager or authorized representative may deduct from the contract value the cost of re-inspection at the rate of \$75.00 per man-hour.

## SECTION 014020 QUALITY ASSURANCE

### PART 1 - GENERAL

### 1.01 DESCRIPTION

- A. This Section identifies inspection activities to be performed by inspectors employed by the City and working under the direction of the City Project Manager.
- B. Inspection and tests, conducted by persons or agencies other than the Contractor, shall not in any way relieve the Contractor of his responsibility and obligation to meet all specifications and the referenced standards.
- C. The inspection and approval of work by other agencies above does not constitute inspection or acceptance of work required by the City. Technical specifications may contain requirements more stringent than Building Inspection Division or other code agency requirements.
- D. Reference Contract General Conditions, GC 1701, GC 1702, GC 1703, GC 1704, GC 1705, GC 1706

## 1.02 RELATED DOCUMENTS

- A. Technical Specifications Section 014000 "Contractor Quality Control"
- B. Technical Specifications Section 013000 "Submittals"
- C. Technical Specifications Section 013400 "Shop and Working Drawings, Product Data and Samples"

### PART 2 - PRODUCTS (NOT USED)

### **PART 3 - EXECUTION**

## 3.01 CONTRACTOR'S QUALITY CONTROL SYSTEM

- A. The Contractor is responsible for quality control of the Construction. All acquisition of materials, sequence of construction (except as otherwise indicated), and means and methods of construction shall be the responsibility of the Contractor. Establish system to perform sufficient inspection and tests of all items of work, including that of subcontractors, to ensure conformance to Contract Documents for materials, workmanship, construction, finish, functional performance and identification.
  - 1. Control System: Establish for all construction except where Contract Documents provide for specific compliance tests by testing laboratories and engineers employed by the City.
  - Control System: Specifically include all testing required by various sections of Specifications.
  - 3. Quality Control System: Means by which Contractor assures himself that construction complies with requirements of Contract Documents.
    - a. Controls: Adequate to cover all construction operations and keyed to proposed

construction schedule.

- B. The Contractor shall be responsible for assuring compliance with the quality standards as indicated in the Contract Documents. In addition, the Contractor shall be responsible for:
  - 1. Review of submittals prior to their being forwarded to the Designer and the City Project Manager for review. The Contractor shall mark submittals with comments and shall indicate the date and party conducting the Contractor's review of each submittal.
  - 2. Final inspection of the project prior to calling for the Designer and City to conduct a final inspection. The Contractor shall provide his inspection comments to the Designer and City prior to the scheduled final inspection.
  - 3. Verification of completion of punch-list items prior to calling for verification inspection by the Designer and the City.
- C. Records: Maintain correct records on appropriate form for all inspections and tests performed, instructions received from the Designer and actions taken as result of those instructions.
  - 1. Records: Include evidence that required inspections or tests have been performed (including type and number of inspections or tests, nature of defects, causes for rejection, etc.) proposed or directed remedial action, and corrective action taken.
  - 2. Document inspections and tests as required by each section of Specifications.
- D. The Contractor is responsible for complying with the requirements of the Contract Documents. Testing performed by the City's Agents shall not be relied upon by the Contractor as sufficient to assure compliance with the Contract Documents. The Contractor shall procure and pay for testing necessary to assure that the construction is in compliance with the Contract Documents.
- E. Quality Control Plan: Submit with proposed Schedule of Values and Construction Progress Schedule. Plan shall include:
  - 1. Personnel, procedures, instructions, and records to be used.
  - 2. List of control tests which Contractor understands he and his subcontractors are to perform.
  - 3. Procedures for reviewing and approving shop drawings, product data, samples and other submittals before submission to the Designer and City Project Manager. Include procedures for obtaining field measurements.
  - 4. Method of documenting quality control operation, inspection and testing including samples of proposed forms.

### 3.02 STANDARDS

- A. Generally accepted Construction Industry standards for materials, products, quality, and workmanship shall supplement the Specifications.
  - 1. Where industry standards are less than the Specifications and Drawings require, the Contract Documents shall govern.
  - 2. The Contractor shall provide materials and products which conform to industry standards of quality.
- B. Construction tasks shall be performed by craftsmen skilled and experienced in the trades required. Work shall be subject to review by the City and the Designer.

C. Work and/or materials which fail to meet accepted industry standards of performance, quality, and/or appearance will be rejected and shall be brought into compliance or replaced by the Contractor at no additional cost to the City.

## 3.03 MATERIAL AND WORKMANSHIP

- A. Unless otherwise specified, or indicated on the Drawings, material shall be new, of best quality, and without flaws, and delivered upon completion in an undamaged condition.
- B. Workmanship shall be the best of its respective kind. Labor shall be performed in a thorough workmanlike manner by qualified, efficient, and skilled mechanics, acceptable to the City, Designer and other trades involved on the job requiring acceptable substrate for the performance of their work.

## 3.04 TESTING – GENERAL

- A. Testing Laboratory and/or Engineering services are required for quality control in portions of the work identified in other sections of these specifications.
- B. Tests required by these Specifications shall be performed in strict accordance with referenced testing methods, procedures, and conditions. Pertinent data shall be included in clear, comprehensive written forms according to the Designer's or Engineer's requirements.
- C. Contractor: Provide equipment and facilities as required for testing at no additional cost, subject to City's review, for conducting field tests and for collecting and forwarding samples.
  - 1. Do not use materials or equipment represented by samples until tests, if required, have been made and materials or equipment found to be acceptable.
  - 2. Do not incorporate any product into work which becomes unfit for use after acceptance thereof.
- D. Testing: Materials or equipment proposed to be used may be tested at any time during their preparation or use. Furnish required samples without charge and give sufficient notice of placing of orders to permit testing. Products may be sampled either prior to shipment or after being received at site of work.
- E. Tests: Made by accredited testing laboratory selected by City. Except as otherwise provided, sampling and testing of materials and laboratory methods and testing equipment shall be in accordance with latest standards and tentative methods of ASTM.
  - 1. Specific information concerning testing methods, sample sizes, etc., is included under applicable sections of Specifications.
  - 2. Any modification of, or elaboration on, these test procedures included for specific materials under their respective sections in Specifications shall take precedence over these procedures.

### 3.05 COST OF TESTING

- A. Unless indicated otherwise, City's testing shall be performed by the City's authorized agents, at the City's expense.
- B. Costs for re-testing of non-complying work shall be borne by the Contractor.
- C. According to the judgment of the City and/or Designer, ANY portion of the work in this contract may be tested at any time for any reason. Costs for such testing shall be borne by the

Contractor only if such tests indicate that work does not meet Contract Document requirements.

# 3.06 OTHER TESTING

- A. Following Testing: Performed at expense of Contractor:
  - 1. Any additional tests required because of any tests that fail subject to following conditions:
    - a. Quantity and Nature of Tests: Determined by the Designer.
    - b. Tests: Taken in presence of the City and/or the Designer.
    - c. Proof of Noncompliance: Contractor liable for corrective action which the City and/or the Designer feel is required including complete removal and replacement of defective material.
  - 2. Material Substitution: Any tests of material or equipment offered as substitute for specified item on which test may be required in order to prove its compliance with Specifications.
- B. Contractor: May have tests performed on material and equipment for his own information and job control so long as the City does not assume responsibility for costs or for giving them consideration when appraising quality of materials.

# 3.07 EQUIPMENT TESTING

- A. Equipment testing shall be as determined appropriate by the City to assure proper performance according to the manufacturer's specifications for each equipment item.
- B. After all utility connections to equipment are completed, the Contractor shall conduct final tests of equipment in presence of the City and the Designer.
- C. Unless waived in writing by the City, the requirements of this section shall apply to all installed equipment items having utility connections.

## 3.08 NOTIFICATION

- A. The Contractor shall be responsible for notifying the City and Designer at least three (3) working days prior to commencing work which is identified as requiring testing.
- B. The Contractor shall be responsible for scheduling and coordinating all required testing with the City and the City's Independent Testing Agency.

### 3.09 TEST REPORTS

- A. Test reports, whether performed for the City or the Contractor, shall be submitted to the City and Contractor as soon as results are available. Reports shall be clear, concise, comprehensive written forms containing required test results.
- B. Reports of tests made by testing laboratories shall be distributed by testing laboratory as follows: 1 Copy – City Project Manager, 1 Copy – Contractor, 1 Copy - Applicable Supplier or Subcontractor; 1 Copy – Designer and Applicable Engineer;

### 3.10 MANUFACTURING AND FABRICATION INSPECTIONS

A. The Project Manager may elect to perform additional inspections and/or tests at the place of the manufacture, the shipping point or at the destination to verify conformance to applicable

specifications. Inspections and tests performed by the City shall not relieve the Contractor from the responsibility to meet the specifications, nor shall such inspections/tests be considered to be a guarantee for acceptance of materials that will be delivered at a later time.

- B. The Project Manager or his authorized representative may inspect at its source any material or assembly to be used in the Work. Manufacturing plants may be inspected from time to time for the purpose of determining compliance with specified manufacturing methods or materials to be used in the Work and to obtain samples for testing and further inspection.
- C. Should the Project Manager conduct plant inspections the following conditions shall exist:
  - 1. The Project Manager shall have the cooperation and assistance of the Contractor and the producer with whom the Contractor has contracted for materials.
  - 2. The Project Manager shall have full access during scheduled production or warehousing working hours to parts of the plant that are concerned with the manufacture, production, storage or shipping of materials being furnished.
  - 3. The Contractor shall arrange for adequate office or working space that can reasonably be needed for conducting a plant inspection. Office or working space shall be conveniently located with respect to the plant and/or warehouse as required by the Project Manager.
- D. It is understood and agreed that the City shall have the right to re-test at the City's expense any materials that have been tested and accepted at the source of supply after it has been delivered to the site.

## PART 4 - MEASUREMENT

### 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

### **PART 5 - PAYMENT**

### 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

## SECTION 015000 TEMPORARY FACILITIES

#### PART 1 - GENERAL

#### 1.01 DESCRIPTION

- A. The Work specified in this Section consists of furnishing, installing, operating, maintaining and removing temporary construction barriers, enclosures and field facilities including the Contractor's construction offices, staging areas, yards, storage areas, electrical power, telephone, water, fire protection and sanitary service.
- B. Construction Office, Yards and Storage Areas
  - 1. Temporary facilities which the Contractor desires to locate in staging areas adjacent to the Work or within the project limits are subject to approval by the Project Manager.
  - 2. Contractor Field Office
    - a. The Contractor shall provide a field office for this Project.
    - b. The Contractor shall acquire all necessary permits for installation and construction work related to the Contractor's field office and fencing.
    - c. The Contractor shall provide, as part of his on-site field office, a conference room for weekly meetings. The conference room shall have one available telephone.
    - d. Jack the mobile office unit off its wheels and provide support.
    - e. Install tie downs in compliance with code.
    - f. Provide access to the field office and easily accessible space for parking six full size passenger automobiles at a minimum. Grade the field office site, access roadway and parking area for drainage, and surface with gravel paving or crushed stone.
    - g. Water and sewer lines to the field office, if installed, shall be installed so they will not freeze.
- C. Electrical Service
  - 1. Reference Contract General Conditions, GC 326.
  - 2. Provide lighting and power for field offices, storage facilities and other construction facilities and areas.
  - 3. Provide power centers for electrically operated and controlled construction facilities including tools, equipment, testing equipment, interior construction lighting, heating, cooling and ventilation equipment.
  - 4. Provide night security lighting at secured areas within construction limits at offices, storage facilities, temporary facilities and excavated areas.
  - 5. Provide battery operated or equivalent emergency lighting facilities at construction areas where normal light failures would cause employees to be subjected to hazardous conditions. Test such facilities monthly and maintain a record of these tests for the Project Manager's review.
  - 6. Bear all costs of temporary electric and water service permits, fees and deposits required by the governing authorities, and connection charges and temporary easements including installation, maintenance and removal of equipment.
- D. Telephone Service
  - 1. The Contractor shall furnish, install and maintain at least two telephones in his main field office. These phones shall be manned at all times by the Contractor's personnel

or by an answering machine.

- E. Internet Service
  - 1. The Contractor shall furnish, install and maintain at least one computer with email in his main field office. This computer should be able to access all email and FTP as part of project submittal process.
- F. Fire Protection
  - 1. Furnish, install and maintain temporary portable fire protection equipment throughout the construction period at all buildings (including the project site), maintenance shops, and fuel storage on all large construction equipment and at the location of any flammable materials or construction materials.
- G. Sanitary Service
  - 1. Furnish, install and maintain temporary sanitary facilities and services throughout the construction period.
  - 2. Ensure that separate or single user toilets shall be provided to ensure privacy between the sexes.
  - 3. Provide general washing facilities adequate for the number of employees.
  - 4. Provide special washing facilities adequate for the number of employees engaged in the application of paints, coating and other volatile or hazardous materials.

# 1.02 QUALITY CONTROL

A. Provide products for, and the execution of, the Work of this Section that will satisfy the requirements of the NEC, OSHA and local codes. Provide products that satisfy requirements of NEMA and are UL listed.

### 1.03 SUBMITTALS

- A. Refer to Technical Specifications Sections 013000 and 013400 for submittal procedures.
- B. Submit a shop drawing within five days of the Notice to Proceed that shows the following:
  - 1. Temporary facilities equipment and materials (include manufacturer's literature)
  - 2. Details and layout of temporary installations including fences, roads, parking, buildings, storage areas and drainage plans.
  - 3. Lighting plan showing temporary lighting facilities, electrical service panel location, electrical circuit diagram and anticipated light level on the working roadway, pathway or construction surface.

## PART 2 - PRODUCTS

# 2.01 ELECTRICAL SERVICE

- A. Provide temporary power and lighting equipment consisting of fixtures, transformers, panel boards, groundings, lamps, switches, poles, conduits and wiring sized and capable of continuous service and having adequate capacity to ensure a complete operating system. Comply with NEMA.
- B. Provide temporary extension cords to supply tools not longer than 200 feet, except that additional length may be used if equipment will be grounded within 200 feet of tool or power.

C. Portable power generators shall be grounded.

## 2.02 DRINKING WATER SERVICE

A. Provide sanitary materials and equipment that satisfies the requirements of codes and regulations pertaining to temporary water systems. Bottled products may be used if those products comply with codes. Clearly label portable containers having a dispensing tap and used only for drinking water. Provide single service disposable cups and a sanitary container for dispensing cups. A trash receptacle shall be provided and maintained beside each portable water supply.

## 2.03 FIRE PROTECTION

A. Fire extinguishers shall be UL rated and shall comply with the current City fire code.

## 2.04 SANITARY SERVICE

- A. Provide materials and equipment adequate for the intended purposes, which will neither create unsanitary conditions nor violate the codes applicable to temporary sanitary facilities. Enclosures for toilet and washing facilities shall be weatherproof, sight proof, ventilated and sturdy.
- B. Provide portable type toilet facilities that satisfy the requirements of OSHA.
- C. Provide washing facilities as needed. Furnish soap, single-service paper towels, towel dispenser and towel receptacle. If paints, coatings and other volatile or hazardous materials injurious to humans will be applied as part of the contract, provide washing facilities with warm water of approximately 120 degrees F.

# PART 3 - EXECUTION

## 3.01 ELECTRICAL SERVICE

A. The approximate location of primary power lines is shown on the Construction Drawings. The Contractor shall locate electrical service where it will not interfere with equipment, storage spaces, traffic, and prosecution of the Work or the work of others. Installation shall present a neat and orderly appearance and shall be structurally sound. Maintain service in a manner that will ensure continuous electrical service and safe working conditions.

### 3.02 TELEPHONE SERVICE

A. Install temporary telephone service in a neat and orderly manner and make structurally and electrically sound to ensure continuous service. Modify, relocate and extend as work progress requires. Place conduit and cable where those products will not interfere with traffic, work areas, materials, handling equipment, storage areas and the work of other contractors. Service lines may be aerial.

# 3.03 WATER SERVICE

- A. Install the systems in a neat and orderly manner. Make them structurally and mechanically sound. Provide continuous service. Modify, relocate and extend the systems as the work progresses.
- B. Locate systems where they will be convenient to work stations, sanitary facilities and first aid station but will not interfere with traffic, work areas, materials handling equipment, storage areas or the work of other contractors.

- C. Install vacuum breakers, backflow preventers and similar devices in a manner and location which will prevent temporary water from returning to the water mains.
- D. Do not incorporate any part of temporary water distribution system into the permanent water distribution system.

## 3.04 FIRE PROTECTION

- A. Install products in conformance with the requirements of the applicable Denver Fire Department and OSHA regulations.
  - 1. Provide functional fire extinguishers that are clearly identified for fire and an accessible supply of water during the period of construction. These fire extinguishers shall remain in place until permanent fire protection systems are functional.
  - 2. Furnish not less than one 20-pound fire extinguisher, type 2A-20ABC within ten feet of cutting and welding operations.
  - 3. Provide 20-pound fire extinguishers, type 2A-20ABC no further then 100 feet apart in buildings.
  - 4. Provide not less than one 20-pound fire extinguisher, type 2A-20ABC on any equipment of 75 horsepower or more.
- B. Instruct construction personnel as to location and use of temporary fire protection equipment.
- C. Fire extinguishers shall be located for easy access. Their location shall be clearly marked so that they can be seen at least 75 feet away.

### 3.05 SANITARY SERVICE

- A. Place temporary sanitary (and washing) facilities in a neat and orderly manner within the limits of the work and convenient to the work stations. Make these facilities structurally and mechanically sound. Modify, relocate and extend the facilities as required by progress of the work.
- B. Service toilets at those time intervals which will minimize the accumulation of wastes and prevent creation of unsanitary conditions, but not less than once a week.
- C. The waste from the sanitary and wash facilities shall be disposed of in accordance with all applicable rules, regulations and laws and with the least environmental impact.

# 3.06 FENCING

A. Contact all utility service companies prior to planning fence location and post locations for certification of current utilities. Locate pothole posts planned within 5 feet of known utilities. Submit fencing plan and typical details to Project Manager at least seven days before planned execution for review and acceptance.

### 3.07 SIGNAGE

A. Contractor shall not provide any signage for temporary facilities without prior approval from the Project Manager.

### 3.08 REMOVAL

- A. The Contractor shall locate all temporary facilities including the underground utilities so they can be completely removed without damaging permanent work or the worksite of other contractors.
- B. The Contractor shall remove all temporary facilities, including all underground utilities, and restore the site to the condition in which the City initially provided it to the Contractor.

## PART 4 - MEASUREMENT

## 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

## PART 5 - PAYMENT

## 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

## SECTION 016200 STORAGE AND PROTECTION

# PART 1 - GENERAL

### 1.01 DESCRIPTION

- A. The Work specified in this Section consists of providing storage and protection of the materials, products and supplies which are to be incorporated into the construction and indicating such storage areas on the working drawings with the location and dates when such areas will be available for each purpose.
- B. Reference Contract General Conditions, GC 803

### 1.02 SUBMITTALS

- A. Refer to Technical Specifications Sections 013000 and 013400 for submittal procedures. Submit concurrently with submittals required in Section 010500.
- B. Submit working drawings showing locations of storage areas not indicated on the Contract Drawings.
- C. Submit descriptions of proposed methods and locations for storing and protecting products.

### **PART 2 - PRODUCTS**

## 2.01 MATERIALS

A. Materials required for the storage and protection of the items specified shall be durable, weatherproof and either factory finished or painted to present an appearance acceptable to the City. Storage facilities shall be uniform in appearance with similar materials used to the maximum extent possible.

## **PART 3 - EXECUTION**

# 3.01 GENERAL REQUIREMENTS OF EXECUTION

- A. Palletize materials, products and supplies which are to be incorporated into the construction and stored off the ground. Store these items in a manner which will prevent damage and which will facilitate inspection. Leave seals, tags and labels intact and legible. Maintain access to products to allow inspection. Protect products that would be affected by adverse environmental conditions.
- B. Periodically inspect stored products to ensure that products are being stored as stipulated and that they are free from damage and deterioration.
- C. Do not remove items from storage until they are to be incorporated into the Work.
- D. The Contractor shall ensure that all protective wrappings and coverings are secure and ballasted to prevent any items from deterioration and/or subsequent dislodgment. All items on the worksite that are subject to becoming windborne shall be ballasted or anchored.

# 3.02 HANDLING AND TRANSPORTATION

- A. Handling
  - 1. Avoid bending, scraping or overstressing products. Protect projecting parts by blocking with wood, by providing bracing or by other approved methods.

- 2. Protect products from soiling and moisture by wrapping or by other approved means.
- 3. Package small parts in containers such as boxes, crates or barrels to avoid dispersal and loss. Firmly secure an itemized list and description of contents to each container
- B. Transportation
  - 1. Conduct the loading, transporting, unloading and storage of products so that they are kept clean and free from damage.

### 3.03 STORAGE

- A. Store items in a manner that shall prevent damage to the owner's property. Do not store hydraulic fluids, gasoline, liquid petroleum, gases, explosives, diesel fuel and other flammables in excavations, except one day's supply of diesel fuel may be stored in open excavations.
- B. Provide sheltered weather-tight or heated weather-tight storage as required for products subject to weather damage.
- C. Provide blocking, platforms or skids for products subject to damage by contact with the ground.
- D. All material shall be stored according to the manufacturer's recommendations. Any material that has to be stored within specified temperature or humidity ranges shall have a 24-hour continuously written recording made of the applicable condition. Should the recording show that the material was not stored within the recommended ranges the material shall be considered defective and in nonconformance. If a certification from the manufacturer's engineering design representative is provided stating that the actual variations are acceptable and will in no way harm the material or affect warranties, then the deficiency will be considered corrected.
- E. Store hazardous material separately, with all material marked with a label showing the hazard and how to treat exposure to the material.

#### 3.04 LABELS

A. Storage cabinets and sheds that will contain flammable substances and explosive substances shall be labeled FLAMMABLE--KEEP FIRE AWAY and NO SMOKING with conspicuous lettering and conforming to OSHA requirements.

### PART 4 - MEASUREMENT

### 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

#### **PART 5 - PAYMENT**

#### 5.01 METHOD OF PAYMENT

A. The cost of the Work described in this Section shall be included in the Contract price. See Technical Specifications Section 013700 for additional requirements for the possible payment of stored material.

## SECTION 016300 SUBSTITUTIONS

#### PART 1 - GENERAL

#### 1.01 DESCRIPTION

- A. The Work specified in this Section consists of submitting for the approval of a different material, equipment or process then is described in the Contract Documents.
- B. If the substitution changes the scope of work, contract cost or contract time, a change order is required. As-built drawings and specifications must include all substitutions even if a change order is not issued.
- C. Reference Contract General Conditions, GC 406.

### 1.02 QUALITY CONTROL

- A. The substitution must provide the same quality as what it is replacing. The level of quality is defined by:
  - 1. Maintenance and operating cost
  - 2. Reliability
  - 3. Durability
  - 4. Life expectancy
  - 5. Ease of cleaning
  - 6. Ability to be upgraded as needed
  - 7. Ease of interacting with other systems or components
  - 8. Ability to be repaired
  - 9. Availability of replacement parts
  - 10. Established history of use in similar environments
  - 11. Performance equal or superior to that which it is replacing.

#### 1.03 SUBMITTAL

- A. Refer to Technical Specifications Sections 013000 and 013400 for submittal procedures.
- B. A complete Request for Substitution using the form in Section 019990 must be made at least 60 days prior to when an order needs to be placed or a method needs to be changed.
- C. The submittal shall contain, as appropriate, detailed product data sheets for the specified items and the substitution. Samples and shop drawings shall also be submitted of the substitution as applicable. The submittal shall contain all the data required to be submitted for acceptance of the originally specified item or process.
- D. The submittal shall contain all the applicable information required in Technical Specifications Section 016300, paragraph 2.01 below.
- E. A signed statement as outlined in Technical Specifications Section 016300, paragraph 2.03.B below must accompany the Request for Substitution.

### **PART 2 - EXECUTION**

SUBSTITUTIONS

## 2.01 INFORMATION

- A. Provide the following information as applicable with the Request for Substitution on the item or process that is being requested to be substituted:
  - 1. A complete description of the item or process
  - 2. Utility connections including electrical, plumbing, HVAC, fire protection and controls
  - 3. The physical dimensions and clearances
  - 4. A parts list with prices
  - 5. Samples of color and texture
  - 6. Detailed cost comparisons of the substitution and the contract specified item or process
  - 7. Manufacturer warranties
  - 8. Energy consumption over a one-year period
  - 9. What local organization is certified to maintain the item
  - 10. Performance characteristics and production rates
  - 11. A list of any license fees or royalties that must be paid
  - 12. A list of all variations for the item or method specified
  - 13. A list of at least three other projects of similar nature to this contract where the products or methods have been in use for at least one year including telephone number and name of the person to contact at these other projects
  - 14. An analysis of the effect of the substitution on the schedule and contract cost and on the overall project as it relates to adjoining work.

### 2.02 SUBSTITUTION REQUEST

- A. The formal Request for Substitution will be evaluated by the Project Manager and the Designer of Record based on the following criteria:
  - 1. Compatibility with the rest of the project
  - 2. Reliability, ease of use and maintenance
  - 3. Both initial and long term cost
  - 4. Schedule impact
  - 5. The willingness of the Contractor to share equally in any cost savings
  - 6. The ability of the item or process to meet all applicable governing regulations, rules and laws along with funding agency requirements
  - 7. The cost of evaluating the substitution.
- B. Based upon the above evaluation the Project Manager will make a final determination of what is in the best interest of the City and either approve, disapprove or approve as noted the requested substitution.

## 2.03 CONDITIONS

A. As a condition for submitting a Request for Substitution the Contractor waives all rights to claim for extra cost or change in contract time other than those outlined in the request and approved by the Project Manager. The Contractor, by submitting a Request for Substitu-

tion, also accepts all liability for cost and scheduling impact on other contractors or the City due to the substitution.

- B. Included with the Request for Substitution shall be the following statement:
  - 1. "The substitution being submitted is equal to or superior in all respects to the contractrequired item or process. All differences between the substitution and the contractrequired item or process are described in this request along with all cost and scheduling data."
- C. The statement shall be signed and dated by the Contractor's Superintendent.

## PART 3 - EXECUTION (NOT USED)

### PART 4 - MEASUREMENT

## 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

## PART 5 - PAYMENT

## 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

## SECTION 016500 SYSTEM STARTUP, TESTING AND TRAINING

# PART 1 - GENERAL

### 1.01 DESCRIPTION OF WORK

A. Provide complete startup, testing and operator training services to ensure operability of all electrical and electronic equipment supplied.

## 1.02 SUBMITTAL

- A. Refer to Technical Specifications Sections 013000 and 013400 for submittal procedures.
  - 1. Test procedures
  - 2. Test report
  - 3. Training outline.

### 1.03 FIELD TESTS AND ADJUSTMENTS

- A. All electrical and mechanical equipment including the interfaces with control systems and the communication system, and all alarm and operating modes for each piece of equipment shall be tested by the Contractor to the satisfaction of the Project Manager before any facility is put into operation. Tests shall be as specified herein and shall be made to determine whether the equipment has been properly assembled, aligned and connected. Any changes, adjustments or replacements required to make the equipment operate as specified shall be carried out by the Contractor as part of the work.
  - 1. At least 30 days before the time allowed in the construction schedule for commencing startup and testing procedures, the Contractor shall submit to the Project Manager six copies of the detailed procedures he proposes for testing and startup of all electrical and mechanical equipment. These procedures are submitted for review and acceptance.
  - 2. The Contractor's startup and testing procedures shall include detailed descriptions of all pre-operational hardware, electrical, mechanical and instrumentation used for testing work. Each control device, item of electrical, mechanical and instrumentation equipment, and all control circuits shall be considered in the testing procedures which shall be designed in a logical sequence to ensure that all equipment has been properly serviced, aligned, connected, wired, calibrated and adjusted prior to operation. Motors shall be tested in accordance with ANSI/IEEE Publication 112. The Contractor is advised that failure to observe these precautions may place the acceptability of the subject equipment in question, and he may either be required to demonstrate that the equipment has not been damaged, or replace it as determined by the Project Manager.
  - 3. Testing procedures shall be designed to duplicate as nearly as possible all conditions of operations and shall be carefully selected to ensure that the equipment is not damaged. All filters shall be in place during startup and testing. Once the Project Manager has accepted the testing procedures, the Contractor shall provide checkout, alignment, adjustment and calibration signoff forms for each item of equipment and each system that will be used. The Contractor and the Project Manager shall use the signoff forms in the field jointly to ensure that each item of electrical, mechanical and instrumentation equipment and each system has been properly installed and tested. The Contractor shall cooperate with project wide systems contractors where startup and testing is to be conducted concurrently.
  - 4. Any special equipment needed to test equipment shall be provided to the City at no cost for a period of 30 days during startup.

- B. Before starting up the equipment, the Contractor shall properly service it and other items, which normally require service in accordance with the maintenance instructions. The Contractor shall be responsible for lubrication and maintenance of equipment and filters throughout the entire equipment "break-in" period described by the manufacturer.
  - 1. The Contractor shall be responsible for the startup, adjustment, preliminary maintenance and checkout of all equipment and instrumentation. All systems shall be carefully checked for conformance with the design criteria.
  - 2. If any equipment or system does not operate as specified in the contract, the Contractor shall immediately replace or repair components until it operates properly.
  - 3. The Contractor shall submit a test report to the Project Manager within 30 days after completion of the system startup period.

## 1.04 SYSTEMS STARTUP AND TESTING

- A. The Contractor shall be responsible for a 30-day startup period during which time all hardware, electrical and mechanical equipment, communications, alarm systems and associated devices shall be energized and operated under local and automatic controls. The Contractor shall be present during the startup period with adequate labor and support personnel to adjust equipment and troubleshoot system failures that might arise.
- B. When a piece of electrical or mechanical equipment is found to be in conflict with specific criteria, an experienced representative of the manufacturer shall make an adjustment to the item.
- C. If adjustments fail to correct the operation of a piece of equipment or fixture, the Contractor shall remove the equipment or fixture from the project site and replace it with a workable replacement that meets the specification requirements.
- D. The 30-day startup period shall commence 30 days prior to the contract completion date and shall be completed prior to final payment. If, during the startup, any system fails to operate in accordance with contract requirements, the failure shall be corrected and the startup period shall begin again. At the end of the startup period, all filters shall be replaced with new ones. The City may, at its option, provide a Commissioning Representative to observe or participate in the startup and testing of any system. The Contractor shall coordinate with the Commissioning Representative relating to scheduling, reporting, forms, methods and procedures of the startup and testing.

# 1.05 FINAL INSTRUCTIONS AND OPERATION TRAINING

- A. After startup and testing is completed, the Contractor shall demonstrate to the City's personnel the proper manner of operating the equipment, programming messages, making adjustments, responding to alarms and emergency signals, and maintaining the system.
- B. The Contractor shall provide on-the-job training by a suitably qualified instructor to designated personnel and shall instruct them in the operation and maintenance of the systems. In the event qualified instructors on the Contractor's staff are not available, the Contractor shall arrange with the equipment manufacturer for such instruction at no additional cost to the City.
- C. The Contractor shall provide a syllabus to the Project Manager at least seven calendar days prior to the start of each course that outlines topics to be covered, the proposed time allotted to each topic, and the target audience of the training session (technical, casual operator, overview, etc.). The Contractor shall not commence any training courses until the syllabus has been reviewed and approved by the Project Manager.

### DTO - COMMAND VEHICLE STORAGE

- D. The Contractor shall videotape all training sessions and provide labeled digital video disks (DVD) to the Project Manager. The Contractor shall provide three copies of the DVD to the Project Manager in DVD+R format.
- E. The Contractor shall provide an annotated syllabus to the Project Manager that indicates topics contained on each tape.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION (NOT USED)

## PART 4 - MEASUREMENT

## 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

## PART 5 - PAYMENT

## 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price. No contractual item requiring startup or testing will be paid until the conditions of this Section are completely satisfied.

## SECTION 017000 CONTRACT CLOSEOUT

#### PART 1 - GENERAL

#### 1.01 DESCRIPTION

- A. Work specified in this Section includes procedures required prior to Final Acceptance of the Work in addition to those specified in General Conditions Title 20 and Technical Specifications Section 017200.
- B. Reference Contract General Conditions, GC906, GC 909, GC 2003.

#### 1.02 PREPARATION FOR FINAL INSPECTION

A. Before requesting inspection for Final Acceptance of the Work by the City, inspect, clean and repair the Work as required.

#### 1.03 FINAL INSPECTION

- A. When the Contractor considers that the Work is complete, he shall submit written certification that:
  - 1. All punch list items have been completed.
  - 2. All clean up at the project site has been accomplished.
  - 3. Work has been inspected by the Contractor for compliance with contract documents.
  - 4. Work has been completed in accordance with contract documents.
  - 5. Work is ready for final inspection by the City.
  - 6. All as-built required documents have been submitted and accepted.
  - 7. All damaged or destroyed real, personal, public or private property has been repaired or replaced.
  - 8. All operation and maintenance manuals have been submitted and accepted and all training has been completed.
- B. The Project Manager will inspect to verify the status of completion with reasonable promptness after receipt of such certifications. The inspection of the work will be done in accordance with the General Conditions.
- C. If the Project Manager finds incomplete or defective work:
  - 1. The Project Manager may, at the Project Manager's sole discretion, either terminate the inspection or prepare a punch list and notify the Contractor in writing, listing incomplete or defective work.
  - 2. The Contractor shall take immediate steps to remedy stated deficiencies and send a second written certification to the Project Manager that Work is complete.
  - 3. The Project Manager will then re-inspect the Work.

# 1.04 REINSPECTION FEES

- A. Should the Project Manager perform re-inspection due to failure of the Work to comply with the claims of status of completion made by the Contractor:
  - 1. The Contractor shall compensate the City for such additional services at the rate of

\$75.00 per man-hour.

2. The City shall deduct the amount of such compensation from the final payment to the Contractor.

## 1.05 FINAL ADJUSTMENT OF ACCOUNTS

- A. Submit a Final Statement of Accounting to the Project Manager.
- B. The Final Statement of Accounting shall reflect all adjustments to the contract amount and shall include the following:
  - 1. The original contract amount.
  - 2. Additions and deductions resulting from:
    - a. Previous change orders.
    - b. Allowances.
    - c. Final quantities for unit price items. Along with this statement shall be detailed backup for the quantities.
    - d. Deductions or corrected work.
    - e. Penalties.
    - f. Deductions for liquidated damages.
    - g. Deductions for re-inspection payments.
    - h. City resurveys required due to the Contractor.
    - i. Other adjustments.
  - 3. Total contract amount, as adjusted.
  - 4. Previous payments.
  - 5. Sum remaining due.
- C. If required, the Project Manager will prepare a final change order, reflecting approved adjustments to the Contract sum which were not previously made by change orders.

### 1.06 FINAL APPLICATION FOR PAYMENT

A. The Contractor shall submit the final application for payment in accordance with the procedures and requirements stated in the General Conditions Title 20.

### PART 2 - PRODUCTS (NOT USED)

### PART 3 - EXECUTION (NOT USED)

### PART 4 - MEASUREMENT

## 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

## PART 5 - PAYMENT

### 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

## SECTION 017100 CLEANING

## PART 1 - GENERAL

#### 1.01 DESCRIPTION

- A. The Work specified in this section consists of maintaining a clean, orderly, hazard free worksite during construction, and final cleaning for the City's Final Acceptance. Failure to maintain the worksite will be grounds for withholding monthly payments until corrected to the satisfaction of the Project Manager.
- B. Reference Contract General Conditions, GC 324, GC 803, GC 2001

### 1.02 JOB CONDITIONS

- A. Safety Requirements
  - Maintain the worksite in a neat, orderly and hazard-free manner in conformance with all federal, state and local rules, codes, regulations and orders, including all OSHA requirements, until Final Acceptance of the Work. Keep catwalks, underground structures, worksite walks, sidewalks, roadways and streets, along with public and private walkways adjacent to the worksite, free from hazards caused by construction activities. Inspect those facilities regularly for hazardous conditions caused by construction activities.
- B. Hazards Control
  - 1. Store volatile wastes in covered metal containers and remove those wastes from worksite daily.
  - 2. Do not accumulate wastes which create hazardous conditions.
  - 3. If volatile and noxious substances are being used in spaces that are not naturally ventilated, provide artificial ventilation.
  - 4. Hazard controls shall conform to the applicable federal, state and local rules and regulations.
  - 5. Provide appropriate waste receptacles in all areas in which employees are working. Waste receptacles shall be kept covered at all times. All materials on site shall be anchored and covered to prevent any objects from becoming wind-borne.
- C. Access
  - 1. Maintain the worksite to permit access by other City contractors as required and to allow access by emergency personnel.

# 1.03 SUBMITTALS

#### **PART 2 - PRODUCTS**

#### 2.01 CLEANING MATERIALS

- A. Utilize the type of cleaning materials recommended by the manufacturer for the surfaces to be cleaned.
- B. Maintain current Material Safety Data Sheets (MSDS) on site for all chemicals.
- C. Ensure proper disposal of all wastes generated from the use of these materials. Must ensure compliance with all environmental regulations.

## PART 3 - EXECUTION

# 3.01 INTERIM CLEANING

- A. Clean the worksite every shift/workday for the duration of the construction contract. Maintain structures, grounds, storage areas and other areas of worksite, including public and private properties immediately adjacent to worksite, free from accumulations of waste materials caused by construction operations. Place waste materials in covered metal containers. All hard concrete, steel, wood and finished walking surfaces shall be swept clean daily.
- B. Remove or secure loose material on open decks and on other exposed surfaces at the end of each workday or more often in a manner that will maintain the worksite hazard free. Secure material in a manner that will prevent dislodgment by wind and other forces.
- C. Sprinkle waste materials with water or acceptable chemical palliative to prevent blowing of dust.
- D. Promptly empty waste containers when they become full and legally dispose of the contents at dumping areas off the City's property.
- E. Control the handling of waste materials. Do not permit materials to be dropped or thrown from structures.
- F. Immediately remove spillage of construction related materials from haul routes, work site, private property or public rights of way.
- G. Clean only when dust and other contaminants will not precipitate upon newly painted surfaces.
- H. Cleaning shall be done in accordance with manufacturer's recommendation.
- I. Cleaning shall be done in a manner and using such materials as to not damage the Work.
- J. Clean areas prior to painting or applying adhesive.
- K. Clean all heating and cooling systems prior to operations. If the contractor is allowed to use the heating and cooling system it shall be cleaned prior to testing.
- L. Clean all areas that will be concealed prior to concealment.

### 3.02 FINAL CLEANING

- A. Inspect interior and exterior surfaces, including concealed spaces, in preparation for completion and acceptance.
- B. Remove dirt, dust, litter, corrosion, solvents, discursive paint, stains and extraneous markings.
- C. Remove surplus materials, except those materials intended for maintenance.
- D. Remove all tools, appliances, equipment and temporary facilities used in the construction.
- E. Remove detachable labels and tags. File them with the manufacturer's specifications for that specific material for the City's records.
- F. Repair damaged materials to the specified finish or remove and replace.

### DTO - COMMAND VEHICLE STORAGE

- G. After all trades have completed their work and just before Final Acceptance, all catch basins, manholes, drains, strainers and filters shall be cleaned; roadway, driveways, floors, steps and walks shall be swept. Interior building areas shall be vacuum cleaned and mopped.
- H. Final cleanup applies to all areas within and adjacent to the site.

### PART 4 - MEASUREMENT

#### 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

## **PART 5 - PAYMENT**

### 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract Price.

## SECTION 017200 CONTRACT RECORD DOCUMENTS

# PART 1 - GENERAL

### 1.01 DESCRIPTION

- A. The Work specified in this Section consists of maintaining, marking, recording and submitting contract record documents which include shop drawings, warranties, contract documents and contractor records.
- B. Reference Contract General Conditions, GC 323

#### 1.02 SUBMITTALS

- A. Each submittal of record documents shall contain the following information:
  - 1. Date
  - 2. Project title and numbers
  - 3. Contractor's name and address
  - 4. Title and number of each record document
  - 5. Certification that each document as submitted is complete and accurate
  - 6. Signature of the Contractor or his authorized representative.
- B. At the completion of this contract, deliver all record documents including the following:
  - 1. As-built shop drawings, diagrams, illustrations, schedules, charts, brochures and other similar data
  - 2. Warranties, guarantees and bonds
  - 3. Contract documents
  - 4. Contractor records.

## 1.03 QUALITY CONTROL

A. Record documents shall be prepared to a high standard of quality, such as that set forth in MIL STD 100, ANSI Standard Drafting Manual Y14 or other relevant lower tier specification defining equal drafting quality for microfilming, except for daily reports.

#### PART 2 - PRODUCTS (NOT USED)

#### **PART 3 - EXECUTION**

#### 3.01 MAINTENANCE OF DOCUMENTS

- A. The Contractor shall maintain at the worksite on a current basis one record copy of all drawings, specifications, addenda, change orders, approved shop drawings, working drawings, product data and samples in good order and marked currently to record all changes made during construction.
- B. Maintain at the field office one copy of the following record documents:
  - 1. Contract Documents
    - a. Contract drawings with all clarifications, requests for information, directives, changes and as-built conditions clearly posted.
    - b. Contract specifications with all clarifications, requests for information, changes,

directives and record of manufacturer actually used along with product trade name.

- c. Reference Standards in accordance with Technical Specifications Section 01091.
- d. One set of drawings to record the following:
  - 1) Horizontal and vertical location of underground utilities affected by the Work.
  - 2) Location of internal utilities; include valves, controls, conduit, duct work, switches, pressure reducers, size reducers, transitions, crosses, tees, filters, motors, heaters, dampers, regulators, safety devices, sensors, access doors and appurtenances that are concealed in the construction shall be shown with dimensions given from a visible and recognizable reference to the item being located in all three dimensions. The drawing shall also reference the applicable submittal for the item being located.
  - 3) Field changes of dimensions and details including as-built elevations and location (station and offset).
  - 4) Details not on original contract drawings but obtained through requests for information or by other communications with the City.
- 2. Contractor Records
  - a. Daily QC Reports
  - b. Certificates of compliance for materials used in construction
  - c. Nonconformance Reports (NCRs)
  - d. Remedial Action Requests (RARs)
  - e. Completed inspection list
  - f. Inspection and test reports
  - g. Test procedures
  - h. Qualification of personnel
  - i. Approved submittals
  - j. Material and equipment storage records
  - k. Safety Plan
  - I. Erosion, sediment, hazardous and quality plans
  - m. Hazardous material records
  - n. First report of injuries

## 3.02 RECORDING

- A. Keep record documents current daily.
- B. Legibly mark copies of the contract drawings to record actual construction.
- C. Legibly mark up each Section of the technical specifications and contract drawings to record:
  - 1. Changes made by change orders, requests for information, substitutions and variations approved by submittals.

### 3.03 DOCUMENT MAINTENANCE

- A. Maintain Documents in a clean, dry and legible condition, which shall be turned over to the City prior to final acceptance.
- B. Do not use record documents for construction purposes.
- C. Make documents available for inspection by the Project Manager and any others having jurisdiction.

### 3.04 MONTHLY REVIEW

- A. Prior to any application for payment, the Project Manager or his designated representative will inspect the record documents to ensure that they are being maintained and contain the most current correct data with particular attention to as-built drawings.
- B. If, during the inspection, the Project Manager determines that the documents are not being maintained and kept current as to as-built conditions, an amount may be withheld from the payment request and deducted from the contract value to cover the City's cost of collecting and recording the as-built contract data. This cost will be determined on the basis of \$75.00 per man-hour of effort.

## PART 4 - MEASUREMENT

# 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

## PART 5 - PAYMENT

# 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

## SECTION 017300 OPERATION AND MAINTENANCE DATA

## PART 1 - GENERAL

#### 1.01 DESCRIPTION

A. The Work specified in this Section consists of preparing and submitting operation and maintenance data for mechanical, electrical and other specified equipment.

### 1.02 SUBMITTALS

- A. Refer to Technical Specifications Section 013000 and 013400 for submittal procedures.
- B. Submit one (1) electronic copy and two (2) bound hard copy of the proposed Operation and Maintenance Data Manual format including a table of contents not less than 90 days prior to acceptance tests and final inspection.
- C. Submit one (1) electronic copy and two (2) bound hard copy of Operation and Maintenance Data Manual within ten days after system startup is complete. These copies shall incorporate any comments made on the previous submittals, along with final readings on all settings and gauges taken while the system is in fully satisfactory operation.

### 1.03 CONTINUOUS UPDATING PROGRAM

A. Furnish one electronic copy of the Contractor's letter indicating that suppliers have been notified to provide updated operation and maintenance data, service bulletins and other information pertinent to the equipment, as it becomes available.

# PART 2 - PRODUCTS

- A. The following products are the requirements of hard copies:
- B. PAPER SIZE 8-1/2 inches x 11 inches.
- C. PAPER White bond, at least 20 pound weight.
- D. TEXT typewritten.
- E. PRINTED DATA Manufacturer's catalog cuts, brochures, operation and maintenance data. Clear reproductions thereof will be acceptable. If this data is in color, all final manuals must contain color data.
- F. DRAWINGS 8-1/2 inches x 11 inches, bound with the text. Larger drawings are acceptable provided they are folded to fit into a pocket inside the rear cover of the manual. Reinforce edges of large drawings.
- G. PRINTS OF DRAWINGS black ink on white paper, sharp in detail and suitable for making reproductions.
- H. FLYSHEETS Separate each portion of the manual with colored, neatly prepared flysheets briefly describing the contents of the ensuing portion.
- I. COVERS Provide 40 to 50 mil, clear plastic, front and plain back covers for each manual. The front covers shall contain the information required in paragraph 3.02 below.

J. BINDINGS Conceal the binding mechanism inside the manual; lockable 3 ring binders shall be provided.

## **PART 3 - EXECUTION**

## 3.01 GENERAL

A. Assemble each operation and maintenance manual using the manufacturer's latest standard commercial data.

## 3.02 COVER

- A. Include the following information on the front cover and on the inside cover sheet:
  - 1. OPERATION AND MAINTENANCE INSTRUCTIONS
  - 2. (TITLE OF STRUCTURE OR FACILITY)
  - 3. (TITLE AND NUMBER OF CONTRACT)
  - 4. (CONTRACTOR'S NAME AND ADDRESS)
  - 5. (GENERAL SUBJECT OF THE MANUAL)
  - 6. (Leave spaces for signatures of the City representatives and acceptance date)

## 3.03 CONTENTS OF THE MANUAL

- A. An index of all volumes in each volume of multiple volume systems.
- B. An index in front of each volume. List and combine the literature for each system in the sequence of operation.
- C. Name, address and telephone numbers of Contractor, suppliers and installers along with the manufacturer's order number and description of the order.
- D. Name, address and telephone numbers of manufacturer's nearest service representatives.
- E. Name, address and telephone number of nearest parts vendor and service agency.
- F. Copy of guaranties and warranties issued to, and executed in the name of, the City.
- G. Anticipated date City assumes responsibility for maintenance.
- H. Description of system and component parts including theory of operation.
- I. Pre operation check or inspection list.
- J. Procedures for starting, operating and stopping equipment.
- K. Post operation check or shutdown list.
- L. Inspection and adjustment procedures.
- M. Troubleshooting and fault isolation procedures for on-site level of repair.
- N. Emergency operating instructions.

- O. Accepted test data.
- P. Maintenance schedules and procedures.
- Q. Test procedures to verify the adequacy of repairs.
- R. One copy of each wiring diagram.
- S. One copy of each piping diagram.
- T. Location where all measurements are to be made.
- U. One copy of each duct diagram.
- V. One copy of control diagram.
- W. One copy of each accepted shop drawing.
- X. One copy of software programs imputable or changeable on site.
- Y. Manufacturer's parts list with catalog names, numbers and illustrations.
- Z. A list of components which are replaceable by the City.
- AA. An exploded view of each piece of the equipment with part designations.
- BB. List of manufacturer's recommended spare parts, current prices and recommended quantities for two years of operation.
- CC. List of special tools and test equipment required for the operation, maintenance, adjustment, testing and repair of the equipment, instruments and components.
- DD. Scale and corrosion control procedures.
- EE. Disassembly and re-assembly instructions.
- FF. Troubleshooting and repair instructions.
- GG. Calibration procedures.
- HH. Ordering information.
- II. Training course material used to train City staff, including slides and other presentation material.

# PART 4 - MEASUREMENT

# 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

# **PART 5 - PAYMENT**

# 5.01 METHOD OF PAYMENT

# DTO - COMMAND VEHICLE STORAGE

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

## SECTION 017329 - CUTTING AND PATCHING

### PART 1 - GENERAL

### 1.1 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. See Divisions 2 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

## 1.2 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
  - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
  - Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
  - 3. Products: List products to be used and firms or entities that will perform the Work.
  - 4. Dates: Indicate when cutting and patching will be performed.
  - 5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.
  - 6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
  - 7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

### 1.3 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their loadcarrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

## 1.4 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

### PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
  - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
  - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.
- B. Construction Indoor Air Quality Management
  - 1. Manage construction waste in accordance with provisions of Section 017419-Construction Waste Management and Disposal.

#### 3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

### 3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

- 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  - 4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
  - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  - 6. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
  - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
  - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
  - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
  - 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  - 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

# SECTION 017400 WARRANTIES AND BONDS

## PART 1 - GENERAL

### 1.01 DESCRIPTION

- A. The Work specified in this Section consists of preparing and submitting warranties and bonds required by these specifications.
- B. Reference Contract General Conditions: GC 111, GC 1501, GC 1502, GC 1503, GC 1801, GC 1802.

## 1.02 SUBMITTALS

- A. Refer to Technical Specifications Section 013000 for submittal procedures.
- B. Submit executed warranties and bonds.

## PART 2 - PRODUCTS (NOT USED)

### PART 3 - EXECUTION

# 3.01 WARRANTIES AND BONDS

- A. Execute the warranties and bonds required by the Contract Documents. Prepare and submit a list of all warranties and bonds on the form provided by the City. Reference Technical Specifications Section 019990.
- B. Provide warranties or bonds for the materials, labor and time period set forth in the sections of these specifications requiring such documents. All warranties shall be in accordance with the Contract General Conditions. Refer to the technical specifications for all specific items requiring longer warranty periods.
- C. Provide all warranties and bonds that the manufacturer or supplier furnishes at no additional cost in regular commercial trade. All warranties shall be in accordance with the Contract General Conditions. Refer to the technical specifications for all specific items requiring longer warranty periods.

## **PART 4 - MEASUREMENT**

## 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

# PART 5 - PAYMENT

### 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

# SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Salvaging nonhazardous demolition waste.
  - 2. Recycling nonhazardous demolition and construction waste.
  - 3. Disposing of nonhazardous demolition and construction waste.

# B. Related Requirements:

- 1. Division 02 Section "Selective Structure Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
- 2. Division 31 Section "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

# 1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

### 1.4 PERFORMANCE GOALS

A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the

use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

- 1. Demolition Waste:
  - a. Asphalt paving.
  - b. Concrete.
  - c. Concrete reinforcing steel.
  - d. Terra cotta/plaster walls.
  - e. Structural and miscellaneous steel.
  - f. Rough hardware.
  - g. Insulation.
  - h. Doors and frames.
  - i. Door hardware.
  - j. Windows.
  - k. Glazing.
  - I. Gypsum board.
  - m. Equipment.
  - n. Cabinets.
  - o. Piping.
  - p. Supports and hangers.
  - q. Valves.
  - r. Mechanical equipment.
  - s. Refrigerants.
  - t. Electrical conduit.
  - u. Copper wiring.
  - v. Lighting fixtures.
  - w. Lamps.
  - x. Ballasts.
  - y. Electrical devices.
- 2. Construction Waste:
  - a. Lumber.
  - b. Wood sheet materials.
  - c. Metals.
  - d. Insulation.
  - e. Carpet.
  - f. Metal studs.
  - g. Gypsum board.
  - h. Piping.
  - i. Electrical conduit.
  - j. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
    - 1) Paper.
    - 2) Cardboard.
    - 3) Boxes.
    - 4) Plastic sheet and film.
    - 5) Polystyrene packaging.
    - 6) Wood crates.
    - 7) Plastic pails.

## 1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 7 days of date established for the Notice to Proceed.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
  - 1. Material category.
  - 2. Generation point of waste.
  - 3. Total quantity of waste in tons.
  - 4. Quantity of waste salvaged, both estimated and actual in tons.
  - 5. Quantity of waste recycled, both estimated and actual in tons.
  - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.
  - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. LEED Submittal: (Not applicable)
- H. Qualification Data: For refrigerant recovery technician.
- I. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

# 1.7 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: General Contractor with a record of successful waste management coordination of projects with similar requirements.
- B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

- C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Meeting shall include contractors affected by the Waste Management Plan. Review methods and procedures related to waste management including, but not limited to, the following:
  - 1. Review and discuss waste management plan including responsibilities of waste management coordinator.
  - 2. Review requirements for documenting quantities of each type of waste and its disposition.
  - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
  - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
  - 5. Review waste management requirements for each trade.

# 1.8 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification. Include separate sections in plan to distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: (Not applicable)
- D. Cost/Revenue Analysis: (Not applicable)

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

# 3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. General Contractor's Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on appropriate separation, handling, and recycling to be used by all parties and proper waste management procedures, as appropriate for the Work occurring at Project site.

- 1. Distribute waste management plan to everyone concerned within three days of submittal return.
- 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
  - 2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.
- E. Waste Management in Historic Zones or Areas: Hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, by 12 inches or more.

# 3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
  - 3. Store items in a secure area until installation.
  - 4. Protect items from damage during transport and storage.
  - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Sale and Donation: Not permitted on Project site.
- C. Salvaged Items for Owner's Use: (Not applicable)
- D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- E. Lighting Fixtures: Separate lamps by type and protect from breakage.
- F. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

# 3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Receivers and Processors: List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following:

| RECYCLING RECEIVERS AND PROCESSORS |                      |                |                  |  |
|------------------------------------|----------------------|----------------|------------------|--|
| CO Resource                        | 400 Marriel Avenue   | (970) 963-8900 | George MacDonald |  |
| Management                         | Carbondale, CO 81623 |                | -                |  |

| Oxford Recycling          | 2400 W. Oxford Avenue<br>Englewood, CO 80110      | (303) 762-1160 | John Kent       |
|---------------------------|---------------------------------------------------|----------------|-----------------|
| Allied Waste              | 10303 E. Dry Creek Rd #250<br>Englewood, CO 80112 | (720) 895-1500 | Bill Kich       |
| Waste-Not                 | 1065 Poplar Street<br>Loveland, CO 80534          | (970 669-9912  | Gary Gettman    |
| Bunting Disposal          | 3315 State Street<br>Evans, CO 80620              | (970) 339-3023 | Bryan Bunting   |
| Phoenix Recycling         | 2501 Delwood Avenue<br>Durango, CO 81301          | (970) 375-1300 | Mark Thompson   |
| Waste Chasers             | 19 Oak Avenue<br>Eaton, CO 80615                  | (970) 454-2497 | Jason Hawk      |
| Colorado All Waste        | 7247 E. County Line Rd<br>Longmont, CO 80504      | (303) 702-9955 | Majori McDonald |
| Patch Construction        | 12655 State Hwy 67<br>Florence, CO 81226          | (719) 784-6236 | David Patch Jr. |
| Pueblo Disposal           | 28900 E. Hwy 96<br>Pueblo, CO 81001               | (719) 948-0047 |                 |
| Construction<br>Endeavors | 2255 E. Las Vegas Rd<br>Colorado Springs, CO      | (303) 375-0785 |                 |

- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
  - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
    - a. Inspect containers and bins for contamination and remove contaminated materials if found.
  - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  - 4. Store components off the ground and protect from the weather.
  - 5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

# 3.4 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
- B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
  - 1. Pulverize concrete to maximum 4-inch size.
- C. Masonry (Terra Cotta): Remove anchors and ties from masonry and sort with other metals.

- 1. Pulverize masonry to maximum 4-inch size.
- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, panel products, and treated wood materials.
- E. Metals: Separate metals by type.
  - 1. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- F. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- G. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- H. Conduit: Reduce conduit to straight lengths and store by type and size.

# 3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
  - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - 2. Polystyrene Packaging: Separate and bag materials.
  - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and trees on-site.
  - 1. Comply with requirements in Division 32 Section "Plants" for use of chipped organic waste as organic mulch.
- C. Wood Materials:
  - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
    - a. Comply with requirements in Division 32 Section "Plants." for use of clean sawdust as organic mulch.
- D. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
  - 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

# 3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.
- D. Disposal: Remove waste materials from Owner's property and legally dispose of them.

# 3.7 SAMPLE FORMS FOR RECYCLING AND WASTE

A. See Division 01 Section "Construction waste Management and Disposal Tracking Form".

# DTO - COMMAND VEHICLE STORAGE

SECTION 017419A - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL TRACKING FORM

# 1.1 SAMPLE FORMS FOR RECYCLING AND WASTE

A. General: The following sample forms should be filled out for each item disposed of to a landfill or recycled. Units shall be by weight or volume, as long as they are consistent for both construction waste and materials that are recycling or salvaged.

# Construction Waste Log

| Date  | Ticket No. | Waste<br>[units] |
|-------|------------|------------------|
|       |            |                  |
|       |            |                  |
|       |            |                  |
|       |            |                  |
|       |            |                  |
|       |            |                  |
|       |            |                  |
| Total |            |                  |

Recycle / Salvage Log

| Date | Ticket No. | Recycled Material Type | Recycled Material<br>[units] |
|------|------------|------------------------|------------------------------|
|      |            |                        |                              |
|      |            |                        |                              |
|      |            |                        |                              |
|      |            |                        |                              |
|      |            |                        |                              |

# SECTION 019990 STANDARD FORMS

# PART 1 - GENERAL

## 1.01 FORMS

A. The forms listed below and appended to this Section will be used for performance of the Work as indicated. This is not a complete listing of all required forms. The Contractor may be permitted to recreate some of the forms so that they are compatible with the Contractors Project Management system. However, Contractor must achieve prior approval from the Project Manager before using modified forms. The Contractor shall properly complete all forms required by the contract or the Project Manager. The Project Manager shall review and approve all submitted forms. If submitted forms are not acceptable the Contractor shall resubmit forms in an acceptable format.

## 1.02 APPENDICES

- A. Attached to this Technical Specifications Section are the following (Sample) forms:
  - 1. Daily Quality Control Report (Sample Attached)
  - 2. Request for Information (Sample Attached)
  - 3. Submittal Transmittal Form (Sample Attached)
  - 4. Document Transmittal Form (Sample Attached)
  - 5. Contractor Warranty (Reference the Contract General Conditions)
  - 6. Contractor/Subcontractor Warranty (Reference the Contract General Conditions)
  - 7. Contractors Certification of Payment (Included within the Bid Documents)
  - 8. Pay Application Form (Reference the Contract General Conditions)
  - 9. Subcontractor Partial Lien Release Form (Included within the Bid Documents)
  - 10. Subcontractor Final Lien Release Form (Included within the Bid Documents)
  - 11. Request for Substitution (Sample Attached)
  - 12. Non-Conformance Report (Sample Attached)

# PART 2 - PRODUCTS (NOT USED)

# PART 3 - EXECUTION

# 3.01 COMPLETING FORMS

A. All documents are to be filled digitally by the Contractor using the format provided by the Project Manager or using Adobe Acrobat 6 or newer. It is at the discretion of the Project Manager if other forms or formats will be accepted.

# 3.02 SIGNING FORMS

A. Original hand written signatures are acceptable for all documents. The Contractor is to fill out the document as indicated above prior to signing the hard copy. If the form is to be submitted digitally to the Project Manager the document shall be scanned and saved as an

Adobe Acrobat 6 or newer file.

- B. Digital signatures are acceptable for all documents. The Contractor is to fill out the document digitally in the format provided by the Project Manager or Adobe Acrobat 6 or newer. The file must be signed using Adobe Acrobat 6 or newer and submitted digitally to the Project Manager.
  - 1. Add digital signatures must contain the name of signer in plain text and the time and date the signature is executed.

# PART 4 - MEASUREMENT

# 4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

# PART 5 - PAYMENT

# 5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

## SECTION 024119 - SELECTIVE STRUCTURE DEMOLITION

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section Includes:
  - 1. Demolition and removal of selected portions of building or structure.
  - 2. Demolition and removal of selected site elements.
  - 3. Salvage of existing items to be reused or recycled.

### 1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

### 1.3 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

### 1.4 INFORMATIONAL SUBMITTALS

A. Predemolition Photographs or Video: Submit before Work begins.

#### 1.5 CLOSEOUT SUBMITTALS

A. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes, if applicable.

#### 1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program. (Not applicable.)

### 1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
  - 1. Before selective demolition, Owner will remove the following items:

a. None.

- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. Hazardous materials will be removed by Owner before start of the Work.
  - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

### 1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties, if applicable.

## PART 2 - PRODUCTS

### 2.1 PEFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

## PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- D. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

- E. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction photographs.
  - 1. Comply with requirements specified in Division 01 Section "Photographic Documentation."

## 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
  - 1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary."
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
  - 2. Arrange to shut off indicated utilities with utility companies.
  - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

### 3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

### 3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flamecutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  - 4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

## DTO - COMMAND VEHICLE STORAGE

- 5. Dispose of demolished items and materials promptly. Comply with requirements in Division 01 Section "Construction Waste Management and Disposal."
- B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

## 3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
  - 1. Do not allow demolished materials to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  - 4. Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

## 3.6 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

### SECTION 033000 - CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
  - 1. Foundation walls.
  - 2. Slabs-on-grade.
- B. Related Sections include the following:
  - 1. Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.

### 1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
  - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
  - 2. Submit substantiating data for each concrete mix design contemplated for use to the Architect/Engineer not less than two weeks prior to first concrete placement. Data for each mix shall, as a minimum, include the following:
    - a. Mix identification designation (unique for each mix submitted).
    - b. Statement of intended use for mix.
    - c. Mixture proportions and descriptions.
    - d. Wet and dry unit weight.
    - e. Water/cementitious materials ratio.
    - f. Total air content.
    - g. Design slump.
    - h. Intended method of placement in field.
  - 3. Shrinkage testing per ASTM C157.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar

arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

- 1. Show all reinforcing, top and bottom profile of concrete element, supports below, and concrete walls, grade beams, joists, etc. framing into the element.
- 2. Provide one continuous elevation at 1/4" scale for all beams, joists, or walls in a common line. Show pockets and openings in shear walls, structural slabs, beams, elevation at top of beams, walls, columns, sections through all beams, pilasters and columns, and placing sequence of reinforcing for items with more than one reinforcing layer.
- 3. Show locations of approved construction joints, splices of reinforcing, type of splice used and splice location, grade of all reinforcement used and specifically identify all ASTM A706 and epoxy coated and galvanized reinforcing.
- D. Submit Data and installation instructions for void forms. Provide Manufacturer's data on factory-made void pieces. Submit evidence void is of proper size and extent after concrete is placed. Submit evidence void form material has degraded as specified herein.
- E. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
  - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity. Submit test reports that no alkali reactivity is produced with the proposed aggregate-cement combinations when tested in accordance with ASTM C227.
- F. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Cementitious materials.
  - 2. Admixtures.
  - 3. Form materials and form-release agents.
  - 4. Steel reinforcement and accessories.
  - 5. Fiber reinforcement.
  - 6. Curing compounds.
  - 7. Bonding agents.
  - 8. Repair materials.
- G. Minutes of pre-installation conference.
- H. Placement notification: Advance notification of concrete placement, submit notification at least 24 hours in advance.
- I. Certification of chloride screen effectiveness for penetrating sealers.
- J. Proposed location of saw cut joints not indicated on the Contract Drawings.
- K. Curing compound data demonstrating specified moisture loss performance.
- L. Evaporative retarder product and application data.

### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
  - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
  - Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
  - Concrete reinforcing steel shall be inspected by personnel experienced in concrete construction and acceptable to the Architect/Engineer. Personnel currently certified as an ACI Concrete Construction Inspector will be accepted.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- F. Formwork: Design and engineering of formwork shall be the responsibility of the Contractor. Design of formwork and preparation of formwork drawings shall be under the supervision of a professional engineer registered in the state of project.
- G. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301 Latest Edition, "Specification for Structural Concrete," Sections 1 through 5.
  - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- H. Mockups: Cast concrete slab-on-grade and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.
  - 1. Build panel approximately 200 sq. ft. for slab-on-grade and 100 sq. ft. for formed surface in the location indicated or, if not indicated, as directed by Architect.
  - 2. Approved panels may become part of the completed Work if undisturbed at time of Substantial Completion.
- I. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
  - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Concrete subcontractor.
    - e. Owner's testing/inspection agency.
  - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.
  - 3. Minutes of the meeting shall be recorded, typed, and printed by the Contractor and distributed by him to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to the following for information purposes: Owner's Representative Consultant Engineer.

The minutes shall include a statement by the concrete contractor indicating that the proposed mix design, and placing, finishing and curing procedures can produce the concrete quality required by these specifications.

- J. Record of Work: Maintain a record listing the time and date of placement of all concrete for the structure. Retain batch tickets for all concrete. Such record shall be kept until the completion of the project and shall be available to the Architect for examination at any time.
- K. Pre-placement Inspection: Formwork installation, reinforcing steel placement, and installation of all items to be embedded or cast into concrete shall be verified by the Contractor prior to placement.

### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

### PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

#### 2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  - 1. Plywood, metal, or other approved panel materials.
  - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. High-density overlay, Class 1 or better.
    - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    - c. Structural 1, B-B or better; mill oiled and edge sealed.
    - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

- 1. Furnish units that will leave no corrodible metal closer than 1-1/2 inch to the plane of exposed concrete surface.
- 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
- 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

### 2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: where welding of reinforcement or field bending is noted on the drawings ASTM A 706/A 706M, deformed.
- C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

### 2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.
- B. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, ASTM A 775/A 775M epoxy coated.
- C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
  - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
  - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
  - 3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

### 2.5 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
  - 1. Portland Cement: ASTM C 150, Type I or II, gray, unless otherwise noted. Supplement with the following:
    - a. Fly Ash: ASTM C 618, Class C or F.
      - 1) Recycled Content: Minimum 20 percent pre-consumer recycled content.
- B. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
  - 1. Maximum Coarse-Aggregate Size: As noted on the drawings.

- 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.

### 2.6 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
  - 7. Non-Chloride, Non-Corrosive Accelerating Admixture: The admixture shall conform to ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures.
  - 8. Mid-range water reducing admixture shall be EUCON X15 or EUCON MR by The Euclid Chemical Company, DARACEM or Mira Series by W. R. Grace or POZZOLITH997 or Rheobuild 3000 by Master Builders and shall conform to ASTM C494 Type A.
- C. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
  - 1. Products:
    - a. Axim Concrete Technologies; Catexol 1000CI.
    - b. Boral Material Technologies, Inc.; Boral BCN2.
    - c. Grace Construction Products, W. R. Grace & Co.; DCI-S.
    - d. Master Builders, Inc.; Rheocrete 222+.
    - e. Sika Corporation; FerroGard-901.

### 2.7 FLOOR AND SLAB TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

#### 2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
  - 1. Available Products:
    - a. Axim Concrete Technologies; Cimfilm.
    - b. Burke by Edoco; BurkeFilm.
    - c. ChemMasters; Spray-Film.
    - d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.

- e. Dayton Superior Corporation; Sure Film.
- f. Euclid Chemical Company (The); Eucobar.
- g. Kaufman Products, Inc.; Vapor Aid.
- h. Lambert Corporation; Lambco Skin.
- i. L&M Construction Chemicals, Inc.; E-Con.
- j. MBT Protection and Repair, Div. of ChemRex; Confilm.
- k. Meadows, W. R., Inc.; Sealtight Evapre.
- I. Metalcrete Industries; Waterhold.
- m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
- n. Sika Corporation, Inc.; SikaFilm.
- o. Symons Corporation, a Dayton Superior Company; Finishing Aid.
- p. Unitex; Pro-Film.
- q. US Mix Products Company; US Spec Monofilm ER.
- r. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. The film must chemically break down in a four to six week period. Provide data from an Independent Laboratory indicating a maximum moisture loss of 0.30 kg/m<sup>2</sup> at 72 hours when tested in accordance with ASTM C156.
- F. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A. Have test data from an Independent Laboratory indicating a maximum moisture loss of 0.30 kg/m<sup>2</sup> at 72 hours when tested in accordance with ASTM C156.
- G. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A. Have test data from an Independent Laboratory indicating a maximum moisture loss of 0.30 kg/m<sup>2</sup> at 72 hours when tested in accordance with ASTM C156.

### 2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

### 2.10 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
  - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

- 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
- 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
- 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
- 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

### 2.11 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
  - 1. Use a qualified testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash: 25 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 for reinforced concrete exposed to chlorides in service 1.00 for reinforced concrete that will be dry and protected from moisture in service percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
  - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

### 2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Proportion structural normal weight concrete mixture as noted on the drawings.
  - 1. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd.

### 2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## 2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information.

## PART 3 - EXECUTION

## 3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Section 017419.

### 3.2 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
  - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
  - 2. Class C, 1/2 inch for rough-formed finished surfaces.
  - 3. The permissible irregularity is a cumulative value due to all sources of error including, but not limited to, layout, plumbness, member sizes, formwork offsets, joints, and member levelness. The permissible irregularity shall also apply between adjacent concrete surfaces on opposite sides of a construction joint, [expansion joint,] [or shrinkage pour strip].
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 1. Install keyways, reglets, recesses, and the like, for easy removal.
  - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
- M. Protect void form materials from moisture at all times before concrete placement.

N. All formwork surfaces that will provide the finish surface of exposed concrete must be accepted by the Architect before depositing concrete.

### 3.3 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges" and with the following additional requirements:
    - a. Tolerance of embedded items: Comply with ACI 117 and the following additional requirements:
      - Anchor Bolts:
         a) Plumbness: Within + 1/16" over the projecting height of the anchor bolt.
      - 2) Embedded Plates and Weldment:
         a) Location: +/-1" vertical, +/- 1" horizontal.
    - b. Plumb and alignment: 1/4" in 12".
  - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

### 3.4 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
  - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
  - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
  - 3. Leave formwork and shoring in place a minimum of 15 days after placing concrete unless reshoring is used.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

### 3.5 SHORES AND RESHORES

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring.

### 3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain concrete cover. Do not tack weld crossing reinforcing bars.
- D. Size, length, number, and placing of supports shall be sufficient to hold reinforcing in the proper position within specified tolerances during construction traffic and concrete placement.
- E. On vertical formwork, use approved bar chairs or spacers as required to maintain proper concrete cover and bar position. Do not staple or use any other metallic fastener to secure bolsters, chairs, etc. to formwork for concrete surfaces exposed to the exterior
  - 1. Weld reinforcing bars according to AWS D1.4, where indicated.
- F. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- G. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

### 3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
  - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
  - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
  - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  - 5. Space vertical joints in walls as indicated. Locate joints beside pilasters integral with walls, near corners, and in concealed locations where possible. Locate at centerline of support or in middle third of span.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
  - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
  - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
  - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

### 3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
  - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
  - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Maintain reinforcement in position on chairs during concrete placement.
  - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - 4. Slope surfaces uniformly to drains where required.
  - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
  - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

### 3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
  - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
  - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

### 3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.
  - 1. Apply scratch finish to surfaces and to receive concrete floor toppings.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
  - 1. Apply float finish to surfaces to receive trowel finish.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or powerdriven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  - 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
  - 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    - a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

- 3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-foot- long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/4 inch
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
  - 1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
  - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

#### 3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

### 3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

- 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape. Moisture-retaining cover shall be inspected each day by Contractor. Any areas which do not show condensation on the underside of the cover or any slab areas which are not wet shall be immediately rewetted and the cover reapplied to prevent moisture loss.
  - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
  - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
  - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
- 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
  - a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
- 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

### 3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning and that are unacceptable to the Architects. Allow Architect/Engineer to observe formed concrete surfaces immediately upon removal of forms and prior to repair of surface defects. Defects in structural concrete shall be brought to the attention of the Architect/Engineer. Repair tie holes and surface defects immediately after such observation. Where the concrete surface will be textured by sandblasting or bush-hammering, repair surface defects before texturing.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template. Submit proposed repair for acceptance prior to beginning this work.
  - 1. Repair finished surfaces containing defects that are unacceptable to the Architect. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  - 2. After concrete has cured at least 14 days, correct high areas by grinding.
  - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Submit proposed repair for acceptance prior to beginning this work.
  - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
  - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  - 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
  - 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

### 3.14 FIELD QUALITY CONTROL

- A. Construction Waste Management and Disposal: Manage construction waste in accordance with provisions of Section 017419.
- B. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- C. Inspections:
  - 1. Steel reinforcement placement embedments, and mechanical connectors.
    - a. Inspect all reinforcing, verifying type of reinforcing, bar sizes, spacings, number of bars, concrete cover to bars, bar locations, splices including splice location and lap splice length or mechanical connector, in place condition of coated bars, and method of support of reinforcing.
    - b. Inspect embedded bolts, plates, and steel shapes. Verify that size and number of bolts or anchors/rebar, embedment, anchorage, use of specified template and general embedment locations are as specified. Welds to embedments shall be tested as specified in Section 051200.
    - c. Welding of reinforcing steel, where permitted, shall be inspected as specified in Section 051200.

- d. Inspect partially embedded reinforcement, which is field bent, or field straightened. Verify that procedures specified in ACI- 301-99 Section 3.3.2.8 "Field Bending or Straightening" are followed. Inspect all field bent bars.
- e. Test rebar anchored into hardened concrete as specified in Section 051200 for adhesive anchors.
- 2. Mechanical Connectors: Perform all special inspections as defined in the code approval report for mechanical connectors. As a minimum the following are required:
  - a. Continuously observe the installation of the first two splices for each type of mechanical connector. Verify all aspects of installation are in accordance with Manufacturer's instructions and code approval report.
  - b. Visually inspect 100% of completed connections to verify installation is in accordance with Manufacturer's instructions and ICBO test report.
  - c. Tension Tests:
    - Tension test failure 1% of all mechanical connectors, up to 20 of each type and each orientation. Select connectors at random and have connector installed by Contractor using the same personnel and procedures as the actual work. Test connector assembly in the shop.
    - 2) If any tension test fails to meet project requirements, test additional mechanical connectors as required by the Architect/Engineer.
- 3. Steel reinforcement welding.
- 4. Headed bolts and studs.
- 5. Verification of use of required design mixture.
- 6. Concrete placement, including conveying and depositing. Inspect the first concrete placement of stemwalls, slab-on-void, and slab-on-metal deck. Inspect each truck for correct mix design, addition of water to each truck and subsequent mixing, cleanliness of forms, concrete vibration, concrete finishing, and concrete curing.
- 7. Curing procedures and maintenance of curing temperature.
- 8. Verification of concrete strength before removal of shores and forms from beams and slabs.
- Temperature of In-Place Concrete: Owner's Testing Agency shall measure and report maximum/minimum temperature of in-place concrete during curing period when concreting in cold weather.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
  - 1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  - Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change. Determine slump of concrete for each truck (at beginning of load) prior to placing drilled piers.
  - 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample but not less than one test for each day's pour of each concrete mixture.
    - a. Where concrete will be exposed to deicing salts, air content tests will be made on samples from the first three batches in the placement and until three consecutive batches have air contents within the range specified, at which time every fifth batch will be tested. This test frequency will be maintained until a batch is not within the range specified, at which time testing of each batch will be resumed until three consecutive batches have air contents within the range specified. These air content tests may be taken on composite samples or on samples from the batch at any time after discharge of two cubic feet of concrete.

- 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
- 5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
- 6. Compression Test Specimens: ASTM C 31/C 31M.
  - a. Cast and laboratory cure four standard cylinder specimens for each composite sample.
- 7. Compressive-Strength Tests: ASTM C 39/C 39M; test one cylinder at 7 days and one set of two specimens at 28 days. Hold one cylinder and test at 56 days if 28-day strength is not achieved.
  - a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
- 8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- 9. Test results shall be reported in writing to Architect, concrete manufacturer, Building Official and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests, concrete supplier & mix ID number. Also include amount of water added at site prior to sampling, ambient air temperature, and concrete wet unit weight. Include time concrete was batched and time when placement was finished.
- 10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- 11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
- 12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 13. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

END OF SECTION 033000

### SECTION 051200- STRUCTURAL STEEL

PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1- Specification sections, apply to work of this section.
- 1.2 SCOPE:
  - A. Extent of structural steel work is shown on the Drawings.
  - B. General Requirements for field Quality Control are specified in Section 014000.
  - C. Other Division 5 Sections include:
    - 1. Steel Joists
    - 2. Steel Decking
    - 3. Cold Formed Metal Framing
    - 4. Metal Fabrications

#### 1.3 QUALITY ASSURANCE:

- A. Fabricator Qualifications: Minimum of five (5) years in fabrication and erection of structural steel for projects of similar size and difficulty. Subject to approval of Architect, Engineer and Owner.
- B. Welder Qualifications:
  - 1. Welding shall be done only by welding operators currently qualified according to AWS D1.1.
- C. Testing Agency:
  - Testing and inspection will be made by an approved testing laboratory selected and paid by the Owner. Contractor shall furnish testing agency access to work, facilities, and incidental labor required for testing and inspection. Retention by the Owner of an independent testing agency shall in no way relieve the Contractor of responsibility for performing all work in accordance with the contract requirements.
  - 2. Furnish the testing agency with the following:
    - a. A complete set of Shop and Erection Drawings.
    - b. Information as to time and place of all rollings and shipment of material to shops.
    - c. Full and ample means and assistance for testing all materials.
    - d. Proper facilities, including scaffolding, temporary work platforms, etc., for inspection of the work in the mills, shop and field.
    - e. Representative sample pieces requested for testing.
    - f. Each person installing connections shall be assigned an identifying symbol or mark, and all shop and field connection shall be identified so that the inspector can refer back to the person making the connection.
- D. Reference Standards:

- 1. Design, Detailing, Fabrication and Erection: Meet requirements of AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, and AISC Code of Standard Practice, (March 7, 2000).
- 2. Welding: Meet requirements of AWS Structural Welding Code D1.1, latest edition.
- 3. High Strength Bolts: Meet requirements of AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts, latest edition.
- 4. Exposed Structural Steel: Meet requirements of AISC Specifications for Architecturally Exposed Structural Steel, latest edition.
- 5. Surface Preparation: Meet requirements of specifications contained in Steel Structures Painting Council's Steel Structures Painting Manual, Volume 2, Systems and Specifications, latest edition.
- E. Structural Steel and Metal Fabrications:
  - 1. The Testing Agency's inspector will perform his duties in such a way that neither fabrication nor erection is unnecessarily delayed or impeded. In no case will the inspector recommend or prescribe the method of repair of a defect.
- F. Welding and Materials:
  - 1. Inspection of welding by the Testing Agency will be such as to assure that the work conforms to specified requirements.
- G. Documentation:
  - 1. The Contractor shall maintain a complete and current set of submittals including shop and erection drawings, copies of all mill test reports, materials testing reports, inspection reports and a discrepancy log of items noted by the Testing Agency to be addressed and/or corrected by the contractor. Each item in the discrepancy log shall be referenced by an item number, with a description of the discrepancy, the date the discrepancy was noted, a description of the corrective action taken (if any) and the date when the corrective action was taken.
  - 2. The Contractor shall maintain a copy of all documentation on-site and accessible by the Architect and Owner's representative.

### 1.4 SUBMITTALS:

- A. Shop Drawings: Submit Shop Drawings as specified under Section 01300. Shop drawings shall be original drawings produced by the subcontractor or supplier, and shall not be reproductions of the contract documents. Clearly indicate profiles, sizes, spacing and locations of structural members, connections, attachments, anchorages, framed openings, size and type of fasteners, cambers, and clearances. Indicate welded connections using standard AWS welding symbols. Clearly indicate net weld lengths, sizes and welding sequences. Shop drawings shall be checked for accuracy by fabricator and initialed by individual responsible for checking prior to submittal to architect for review.
- B. Connections:
  - 1. Where connections are not shown, submit fabricator Standard Framed Beam Connections, as shown in the AISC Manual of Steel Construction, 13th Edition, at least 4 weeks prior to main Shop Drawing submittal and prior to the creation of Shop Drawings. Such sheet shall indicate the types of beam and column connections to be utilized in the project, and shall include a table of connection capacities, lengths and sizes of welds, number and spacing of bolts, steels thicknesses and lengths, and allowable copes shall be indicated. Connections that are not shown in the AISC Manual of Steel Construction shall be considered alternate connections and subject to the requirements below.
  - 2. If the contractor elects to propose alternate connection details, a substitution request shall be submitted in accordance with these specifications. Shop drawings indicating alternate connection details without Architect's prior approval of substitution request will be rejected.

- 3. Submit Alternate Fabricator Preferred Standard Connection with design calculations bearing the seal and signature of a Professional Engineer registered in the State of Colorado and employed by the Contractor at least 4 weeks prior to the main Shop Drawings submittals, and prior to the creation of the shop drawings.
- 4. Submit design calculations, bearing the seal and signature of a Professional Engineer registered in the State of Colorado and employed by the Contractor, for all other connections not completely detailed or not indicated on the Structural Drawings.
- 5. Design and provide connections to support the loads indicated on the Structural Drawings. When loads are not shown, provide connections to support the loads given in the Structural General Notes on the Structural Drawings.
- 6. All design calculations shall be in conformance with the referenced standards cited herein and shall clearly demonstrate applicability for the intended use.
- C. Other Design Calculations:
  - Submit design calculations, bearing the seal and signature of a Professional Engineer registered in the State of Colorado and employed by the Contractor, for any request for Substitution of member sizes or material grades or any Modification of strength or configuration of the structural framing requested for the Contractor's convenience, erection sequence, or construction equipment and/or materials.
  - 2. All design calculations shall be in accordance with the reference standards cited herein and shall clearly demonstrate applicability for the intended use.

#### 1.5 DELIVERY, STORAGE AND HANDLING:

- A. Materials to be Installed by Others: Deliver anchor bolts and other anchorage devices which are embedded in cast-in-place concrete or masonry construction to the project site in time to be installed before the start of cast-in-place concrete operations or masonry work.
- B. Provide Setting Drawings, templates and directions for installation of anchor bolts and other devices.
- C. Storage of Structural Steel: Structural steel members which are stored at the project site shall be above ground on platforms, skids, or other supports and stored upright to prevent twisting. Protect steel from corrosion. Store other materials in a weather-tight and dry place, until ready for use. Store packaged materials in their original, unbroken package or container.

#### 1.6 JOB CONDITIONS:

A. Protection: Protect any adjacent materials or areas below from damage due to weld splatter or sparks during field welding.

### PART 2 - PRODUCTS

### 2.1 MATERIALS:

- A. Structural Steel: Unless otherwise noted or indicated, all W shapes shall meet requirements of ASTM A992. All other structural steel shapes and plates shall meet either ASTM A572 Grade 50 with special requirements per Technical Bulletin 3, March 1997 or ASTM A36.
- B. Unfinished Bolts: Meet requirements of ASTM A-307, Carbon Steel Externally and Internally Threaded Standard Fasteners, latest edition with washers and hexagonal heads and nuts.
- C. High Strength Bolts: Meet requirements of ASTM A-325, Type 1, High Strength Bolts for Structural Steel Joints, including suitable nuts and plain hardened washers, latest edition. All ASTM A 325 high strength bolts for slip critical and/or axial tension type connections shall be Lohr Rapid Tension Bolts as

manufactured by Lohr Structural Fasteners, Inc., Humble, Texas or approved equal. Nuts and bolts shall be manufactured by the same entity to insure proper fit.

- D. Pipe: Meet requirements of ASTM A-53, Type E or S, Grade B, ASTM A-500, Grade B, or ASTM A-501 excluding furnace butt welding, latest editions. Provide seamless pipe where pipe is utilized as a sleeve.
- E. Tube: Meet requirements of ASTM A-500, Grade B, latest edition. Provide seamless tube where tube is utilized as a sleeve.
- F. Shear Stud Connectors: Meet requirements of AWS D1.1 Structural Welding Code, latest edition.
- G. Filler Metals for Welding: Meet requirements of AWS D1.1, 70 Series.
- H. Shop Primer: Fabricator's standard alkyd red oxide, rust-inhibiting primer. Where steel is to be field painted, provide shop primer compatible with finish paint system specified in Division 9.
  - 1. Regulatory Requirements: Primer VOC, lead and chromate levels shall comply with all federal standards and with applicable regulations of state governments both at location of fabricator's shop and at Project site.
- I. Anchors: Size and type as noted on the drawings.
  - 1. Anchor Rods: ASTM F1554, Grade 36 or 105, as indicated on the drawings. Size and length as shown on the drawings. Provide suitable nuts and washers as recommended in ASTM F1554.
  - 2. Expansion Anchor: Torque-controlled, wedge type complete with suitable nut and washer with galvanized finish in accordance with ASTM A153 with current ICC approval and published ICC evaluation report. Size and type as indicated on the drawings. Install per manufacturer's instructions. Provide KWIK Bolt 3 Concrete Anchor by Hilti, Inc. or approved equal. Provide stainless steel anchors where indicated on the drawings.
  - 3. Adhesive Anchors: Anchor system shall consist of adhesive, threaded rod, nut and hardened washer. Size and type as indicated on the drawings.
    - a. Adhesive: The epoxy adhesive shall be a hybrid urethane methacrylate, two-part, moistureinsensitive epoxy adhesive with ICC approval for use in normal and light-weight concrete.
    - b. Threaded rod: ASTM A36, zinc-coated finish. For installations in corrosive or damp conditions, provide galvanized finish in accordance with ASTM A153, Class C or C.
    - c. Nut: ASTM A63, Grade A. Finish to match threaded rod.
    - d. Washer: ANSI B18.22.1, Type A. Finish to match threaded rod.
    - e. Approved anchor: HIT RE-500 SD Adhesive Anchor by Hilti, Incorporated.

### 2.2 FABRICATION:

- A. General:
  - 1. Meet requirements of standards listed under 1.3.D. Reference Standards.
  - 2. Fabricate and assemble structural assemblies in shop to greatest extent possible as indicated on final shop drawings. Provide camber in structural members where indicated.
  - 3. Detailing and fabrication procedures shall account for distortion and shrinkage due to welding processes, both in the shop and in the field.
- B. Connections:

- 1. Provide connections as shown or noted on the Drawings. Connections not shown or noted shall be standard Framed Beam Connections as shown in AISC Manual of Steel Construction, 13th Edition, Section 10.
- 2. No combination of bolts and welds shall be used to transmit stress in the same faying surface of any connection.
- 3. Shop connectors shall be welded or bolted using high-strength bolts.
- 4. Field connections: Bolt field connections except where welded connections are indicated.
  - a. Provide high-strength bolts for principal connections including all beam to beam and all beam to column connections.
  - b. Provides high-strength or unfinished bolts for connections of secondary framing members including girts and other framing members taking only nominal stresses.
- C. Shop Painting:
  - 1. Surface Preparation: After fabrication and shop assembly, clean all steel members, plates, connection angles and miscellaneous pieces. Remove loose rust, loose mill scale and spatter, slag or flux deposits.

For steel not to receive shop primer, clean steel of grease and oil with solvent cleaners and of dirt and other foreign materials by sweeping with a fiber brush or other suitable means.

For steel to receive shop primer, prepare surfaces to be painted according to the requirements of SSPC Specification SP-2 "Hand Tool Cleaning".

For surface preparation of painted, architecturally exposed structural steel (AESS), prepare surfaces according to the requirements of SSPC Specification SP-6 "Commercial Blast Cleaning".

 Painting: Immediately after surface preparation, apply primer in accordance with the manufacturer's recommendations at a rate to provide a uniform dry film thickness of not less than 1.5 mils per coat. Use painting methods which result in full coverage of joints, corners, edges and exposed surfaces.

Omit shop paint on surfaces to be enclosed in concrete, surfaces to be welded, contact surfaces in high-strength bolted, slip-critical connections, tops of beams in composite construction, surfaces to receive welded studs, surfaces to receive spray on fireproofing, or surfaces in contact with self-lubricating bearing plates. All other steel shall be shop primed.

- D. Marking: Mark all members in protected, plainly visible locations in accordance with reference numbers on setting diagrams. The member work point at each end of columns shall be determined and marked in the shop with a center punch or other acceptable means. Marking shall be placed on the flanges and web at each end of columns. Work point shall be as defined in AISC Code of Standard Practice, Section 7.11.2(a).
- E. Finished Work: All work shall be finished in accordance with the approved Shop Drawings and shall be true and free from twists, kinks, buckles, open joints and other defects.
- F. Cutting and Fitting: Perform all necessary cutting, fitting and drilling for the accommodation of other trades and do whatever is necessary to secure correct information for same, both before and after steel is delivered. No cutting or drilling will be permitted on the job without the approval of the Engineer.
- G. Milling: Subassemblies with milled surfaces shall be completely assembled and welded before milling.

- H. Welding: Comply with AISC specifications and latest American Welding Society standards. Welds not specified shall be 3/16" fillet continuous but not less than the AISC minimum based on thickness of the parts to be joined.
- I. Splices: Splicing of members to obtain the required lengths will not be permitted without prior acceptance of the Engineer unless shown on the Drawings.
- J. Cambering: Beams and girders shall be cambered where indicated on the Drawings.
- K. Substitutions: Where exact sizes and weights called for are not readily available, secure the Engineers' acceptance of suitable sizes in time to prevent delay due to such substitutions.
- L. Equipment Supports and Mechanical Opening Framing: Framing shown on structural drawings is for general arrangement only and may require modification to suit the actual purchased equipment. Coordinate with mechanical trades for necessary certified drawings before starting fabrication. Steel fabricator shall provide a complete job ready for installation of equipment, and contract price shall cover this requirement regardless of subsequent modifications to framing shown on drawings, at no extra cost to the Owner.

#### 2.3 ANCHORS

- A. Provide all anchors for columns, beams, channels, plates, etc., as indicated on Drawings, located on Shop Drawings, or as required.
- 2.4 PAINTS AND COATINGS
  - A. See Division 09, Finishes.

#### PART 3 - EXECUTION

- 3.1 INSPECTION:
  - A. Prior to start of erection, the steel erector shall check the location of all bearing surfaces and all embedded anchor bolts and connection plates, and shall report deviations from the contract documents to the Architect and Engineer in writing. Do not proceed with erection until all unacceptable conditions have been corrected.
- 3.2 PREPARATION:
  - A. Field Measurements: Take measurements on site as required for correct fabrication and installation. Fabricator shall be responsible for errors in fabrication and for correct fit of structural steel.

### 3.3 ERECTION:

- A. General: Erect structural steel in accordance with AISC Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings, latest edition, including supplements, with additional requirements of this section.
- B. Base and Bearing Plates: Set base and bearing plates and leveling plates level (+/- 1/32") and at correct elevations (+/- 1/16"). Support on steel wedges or shims until supported members are plumbed and grouting is completed. Grout shall be quick setting, non-metallic, non-shrink grout, having a compressive strength of 4,000 psi in 24hr.
- C. Field Assembly:
  - 1. Assemble structural steel frames to the lines and elevations indicated within the specified erection tolerances.
  - 2. Align the various members forming a complete frame or structure after assembly and adjust accurately before being fastened.

### STRUCTURAL STEEL

- 3. Measure and adjust for distortion and shrinkage of field welded assemblies as erection proceeds. Submit procedure to Testing Agency for review prior to start of erection.
- 4. Splice only where indicated on Drawings.
- D. Field Connections: Make field connections with bolts, high strength bolts or field welding unless otherwise indicated. Clean existing surfaces before welding to existing steel. No drifting or cutting to enlarge unfair holes will be allowed. Make minor corrections by reaming. Serious defects may not be corrected in the field but shall be called to the attention of the Engineer for a decision as to the method and/or procedure.
- E. Bolting:
  - 1. Non Slip-Critical Connections:
    - a. All connections not required to be slip-critical and/or axial tension shall be Shear/Bearing Connections.
    - b. All Shear/Bearing Connections shall use the specified standard high-strength bolts.
    - c. All bolts shall be tightened to the snug tight condition. "Snug tight condition is defined as the tightness that exists when all plies in a joint are in firm contact (per AISC)".
    - d. Where exposed-to-public-view bolts are allowed and shown on the shop drawings, space at regular intervals in straight lines or uniform patterns.
- F. Compression Splices: Fasten splices in compression after bearing surfaces have been brought into contact. Clean bearing surfaces before assembling. All gaps 1/32" wide or greater shall be closed by driving non-tapered mild steel shims full depth of the bearing surface along the full length of the gap.
- G. Temporary Bracing: Consider all structural steel as non-self-supporting steel frames. Provide suitable temporary bracing as necessary to maintain structural steel in proper position until permanently secured. Leave temporary bracing in place as required for safety.
- H. Field Modification: Written acceptance from the Engineer must be obtained before using cutting torch for field modification or refabrication of structural steel. The structural steel fabricator shall be responsible for errors in fabrication and for correct fit in the field.
  - 1. Erection Tolerances: Comply with requirements of AISC Code of Standard Practice.
- I. Support of Other Work: No permanent loading other than the weight of supported metal deck and concrete slabs shall be imposed on composite beams and girders without prior approval by the Structural Engineer until the concrete in such slabs has achieved 75 percent of its design strength. Contractor shall submit calculations prepared by a Structural Engineer registered in the State of Colorado verifying the adequacy of the non-composite members to support the anticipated loading. All costs associated with the accommodation of such loading, including review of submittals and modification of structural members and/or details, shall be borne by the Contractor.

# 3.4 FIELD QUALITY CONTROL:

- A. Testing and Inspections: All quality control tests and inspections required herein will be performed by the Owner's independent testing and inspections agency (Testing Agency) employed under the terms of Technical Specifications Section 014000. Quality assurance testing and inspections are for the Owner's benefit and use, and are not to be construed as limiting Contractor's contractual responsibility for performing work in accordance with the Contract Documents.
- B. Coordination and Assistance: The Owner's testing and inspection agency will maintain a complete set of shop and erection drawings, copies of all mill test reports, and full and ample means and assistance for testing all materials, including proper facilities, scaffolding, temporary work platforms, etc., in mill, shop, and field.

- C. The testing agency's inspector will perform his duties in such a way that neither fabrication nor erection is unnecessarily delayed or impeded. In no case shall the inspector recommend or prescribe the method of repair of a defect.
- D. Shop Inspection:
  - Shop inspection by the Testing Agency for all columns, trusses, and special fabrications, and 20% of beams and girders shall include examination of steel for member size, straightness and alignment, conformance to length tolerances, fissures, mill scale, and other defects and deformities, as described in ASTM A6, and examination of aforementioned fabricated pieces for conformity with approved shop drawings. Testing of welding will be performed as required herein.
- E. Field Inspection: Field inspection by the Testing Agency of erected steel shall be such as to assure that the work conforms to specified requirements and will include:
  - 1. Inspection of field welding as required herein.
  - 2. Ascertainment of proper fit and alignment.
  - 3. Ascertainment of proper installation and tensioning of bolts.
  - 4. Ascertainment that Contractor's erection procedures adequately correct for distortion and shrinkage in field welded assemblies and connections. The Testing Agency shall measure weld shrinkage at all groove welded column splices in the first four tiers and at each third tier thereafter. Reports of such measurements shall be submitted to the Architect and Structural Engineer within two days of completion of welding at each tier measured.
- F. Welding Materials and Workmanship: Inspection of welding will be such as to assure that the work conforms to specified requirements, and will include:
  - 1. Ascertainment that electrodes used for manual shielded metal-arc welding and the electrodes and flux used for submerged arc welding conform to the requirements of this section.
  - 2. Ascertainment that the approved welding procedure and the approved welding sequence are followed without deviation, unless specific approval for change is obtained from the Architect.
  - 3. Ascertainment that the welding is performed only by welding operators and welders who are properly certified. The Testing Agency shall witness such qualification testing of welding operators and welders, as may be required.
  - 4. Ascertainment that the fit-up, joint preparation, size, contour, extent of reinforcement, and length and location of welds conform to specified requirements and the contract drawings, and that no specific welds are omitted or unspecified welds added without approval of the Architect.
- G. Welder Identification: Assign an identifying symbol or mark to each person installing welded connections; identify all shop and field connections so that the inspector can refer to the person making connection.
- H. Shop Welds: The Testing Agency shall perform tests in the fabricator's shop as follows:
  - 1. All welds: 100% visual.
  - 2. All partial or full penetration groove welded connections and splices: 100% ultrasonic.
  - 3. All other welds: 10% magnetic particle.
  - 4. Embedded Plates and Assemblies: Embedded plates and assemblies shall have all welded reinforcing tested by magnetic particle and all stud connectors tested in accordance with the following article "Stud Connectors" in the following quantities:
    - a. Assemblies supporting structural elements: 100%
    - b. Assemblies supporting all other elements: 50%

- I. Field Welds: The Testing Agency shall test field welds as follows:
  - 1. All welds, including wall and shoring connections: 100% visual.
  - 2. All partial or full penetration groove welds: 100% ultrasonic.
  - 3. All other welds, including curtain wall and shoring connections: 10% magnetic particle.
  - 4. Radiographic testing may be substituted for ultrasonic.
- J. Additional Testing:
  - 1. If more than 10 percent of the tested welds are rejected, then an additional 10 percent of all such welds shall be tested using the same method. This 10 percent additional testing process shall be repeated until the rejection rate drops below one in 10.
  - 2. In addition, if defective welds are discovered, the remaining uninspected welds shall receive such ultrasonic or magnetic particle inspection as may be required by the Architect.
  - 3. All costs of additional inspection and testing required by this paragraph shall be borne by the Contractor.
- K. Authority for Rejection: The welding inspector shall have the authority to reject weldments. Such rejection may be based on visual inspection where in the inspector's opinion the weldment would not pass a more detailed investigation.
- L. Reports: Reports by the Testing Agency's inspector shall contain, as a minimum, an adequate description of each weld tested, the identifying mark of the welder responsible for the weld, a critique of any defects noted by visual inspection or testing, and a statement regarding the acceptability of the weld tested, as judged by current A.W.S. standards. Reports shall be distributed as early as possible, but not later than one (1) work week after the tests have been performed. The Architect shall be notified by telephone if, in the judgment of the inspector, test results require immediate comment.
- M. Bolted Connections: Visually inspect all bolted connections to ascertain that all bolts, nuts and required washers have been installed and are of proper type and that all faying surfaces have been brought into snug contact.
- N. Bolt Quality: Test random samples of each type bolt with nuts and washers to verify compliance with respective ASTM requirements. Test two bolt assemblies (bolt, nut, washer) from each barrel, keg, box, or other container delivered to site.
- O. Drilled-In Anchors:
  - 1. Equipment: Prior to installation of drilled-in anchors, verify that the Contractor has the proper equipment for drilling holes of proper diameter and length in the applicable substrate.
  - 2. Visual Inspection: Visually inspect all anchors after installation to ensure installation perpendicular to the substrate and to proper depth.
  - 3. Adhesive Anchors: Observe on-site installation on the first fifty anchors. Verify that drilled holes are of proper diameter and depth, that holes are properly cleaned prior to installation of anchors, and that holes are completely filled with properly mixed adhesive after installation. Following inspection of the first fifty anchors, observe the remaining adhesive anchors at a rate similar to inspection of non-adhesive anchors.
  - 4. Non-Adhesive Anchors: Inspect not less than 20 randomly selected anchors of each type at each structural level for tightness using a method recommended by the Testing Agency and approved by the Architect and Engineer. If at any time the number of rejectable anchors exceeds 5% of that type anchor tested at that level, test all anchors at that level using the same test method. Continue testing at the 100% rate on each succeeding level until 5% or less of the anchors tested at any

level are found to be rejectable. All costs of additional inspection and testing required by this paragraph shall be borne by the Contractor.

# 3.5 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Section 017419.

END OF SECTION 051200

SECTION 052000 - STEEL JOISTS

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS:
  - A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1- Specification sections, apply to work of this section.
- 1.2 SCOPE:
  - A. Extent of steel joists is shown on the Drawings.
  - B. General requirements for field quality control are in Section 014000.
  - C. Other Division 5 Sections include:
    - 1. Structural Steel
    - 2. Steel Deck
    - 3. Cold Formed Metal Framing
    - 4. Metal Fabrications

### 1.3 QUALITY ASSURANCE:

- A. Welder Qualifications: Welding shall be done only by certified welding operators currently qualified according to AWS D1.1.
- B. Manufacturer Qualifications: Joist manufacturer must be a member of the Steel Joist Institute and regularly engaged in the manufacture of the products supplied.
- C. Testing Agency: Testing and inspection will be made by an approved testing laboratory selected and paid by the Owner. Contractor shall furnish testing agency access to work, facilities and incidental labor required for testing and inspection. Retention by the Owner of an independent testing agency shall in no way relieve the Contractor of responsibility for performing all work in accordance with the contract requirements.
- D. Reference Standards:
  - 1. Materials, Fabrication, Design and Erection:
    - a. Steel Joists: Meet all applicable requirements of Steel Joist Institute Standard Specifications for Open Web Steel Joists K Series, K Series joist substitutes, and joist girders, latest edition.
  - 2. Welding: Meet requirements of AWS Structural Welding Code, D1.1, latest edition.

#### 1.4 SUBMITTALS:

- A. Shop Drawings: Submit Shop Drawings as specified under Section 01300. Indicate sizes, spacing and location of joists, connections, bridging, reinforcing anchorages, cambers, loads and all accessories. Indicate welded connections using Standard AWS welding symbols.
- B. Design Calculations: Submit design calculations, bearing the seal and signature of a Professional Engineer, employed by the Contractor and registered in the State of Colorado for all steel joists. Such calculations shall be in conformance with the reference standards cited herein and shall clearly demonstrate applicability for the intended use.
- 1.5 DELIVERY, STORAGE AND HANDLING:
  - A. Store steel joists at the job site on platforms, skids or other supports and upright to prevent twisting. Inspect joists upon delivery. Repair or replace damaged joists as directed by the Architect. Keep joists free from dirt and mud during storage and erection.

### 1.6 JOB CONDITIONS:

A. Protection: Protect any adjacent materials or areas below from damage due to weld splatter or sparks during field welding.

#### PART 2 - PRODUCTS

#### 2.1 JOISTS:

- A. Construction: Construct joists to conform to Standard Specifications and in sizes, types and lengths indicated on the Drawings. Slope bearing plates where indicated on Drawings, or required.
- B. Shop Painting: Dip, spray or paint all joists with one coat of manufacturer's standard primer complying with SJI specifications for web and chord members. Where steel is to be field painted, provide shop paint compatible with finish paint system specified in Division 9.
  - 1. Regulatory Requirements: Primer VOC, lead and chromate levels shall comply with all federal standards and with applicable regulations of state governments both at location of fabricator's shop and at Project site.
- C. Bridging: Standard specifications unless otherwise indicated.
- D. Extended Ends: Design for load carrying capacity equal to joists, or as indicated on Drawings, whichever is greater.
  - 1. Accessories: Provide all accessories as required and as indicated on the Drawings.

#### PART 3 - EXECUTION

#### 3.1 INSPECTION:

A. Prior to start of erection, the joist erector shall check the elevation and location of all bearing surfaces and shall report all deviations from the approved Shop Drawings to the Architect and General Contractor. The erector shall also verify that all joists are undamaged and ready for erection. Damaged or twisted joists will be repaired or replaced as directed by the Architect.

#### 3.2 ERECTION:

- A. General: Handle and erect joists in conformance with standard specifications and in the locations indicated on the Drawings. Do not drop or rack to cause permanent twist. Joists dropped or damaged during erection are subject to replacement.
- B. Welding: Unless noted otherwise, weld all joists to steel bearings.
- C. Bridging: Adjustment of bridging location will be permitted for clearances of ducts, mechanical equipment, recessed lighting fixtures, etc. subject to acceptance by the Architect.
- D. Complete bridging and sidewall anchors before any loads are applied to the joist system.

### 3.3 TOUCH-UP PAINTING:

A. Touch-up damaged areas of shop paint with similar paint where joists are exposed to view or weather.

# 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: A qualified independent testing agency employed and paid by the Owner will perform field quality-control testing.
- B. Inspect steel joists in accordance with the requirements of Section 051200 Structural Steel.

# 3.5 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Section 015240.

END OF SECTION 052000

### SECTION 053000 - STEEL DECK

PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1- Specification sections, apply to work of this section.
- 1.2 SCOPE:
  - A. Extent of Steel Deck is shown on the Drawings.
  - B. Field Quality Control is in Section 014000.
  - C. Other Division 5 Sections include:
    - 1. Structural Steel
    - 2. Steel Joists
    - 3. Cold Formed Metal Framing
    - 4. Metal Fabrications

### 1.3 QUALITY ASSURANCE:

- A. Welder Qualifications: Welding shall be done only by welding operators currently qualified according to AWS D1.3.
- B. Manufacturer Qualifications: Regularly engaged in production of steel decking.
- C. Erector Qualifications: Minimum of five (5) years experience in erection of steel decking for projects of similar size and difficulty. Subject to approval of Architect, Engineer and Owner.
- D. Testing Agency: Testing and inspection will be made by an approved testing laboratory selected and paid by the Owner. Contractor shall furnish testing agency access to work, facilities and incidental labor required for testing and inspection. Retention by the Owner of an independent testing agency shall in no way relieve the contractor of responsibility for performing all work in accordance with the contract requirements.
- E. The Testing Agency will visually inspect all steel deck to observe that material is in acceptable condition and has been properly installed.
- F. The Testing Agency shall visually inspect all deck welds prior to being covered by other work.
- G. Design Criteria: See Drawings for loading requirements, minimum section properties and span. Design shall comply with the following:
  - 1. Non-Composite Roof Deck:
    - a. Maximum Flexural Working Stress: 20,000 psi.
    - b. Maximum Roof Deflection: 1/240 span length, center to center of supports under live load.
- H. Reference Standards:
  - 1. Design and Manufacturer: Meet requirements of Steel Deck Institute Basic Design Specifications and AISC North American Specification for Design of Cold-Formed Steel Structural Members (NASPEC), latest edition.
  - 2. Welding Meet requirements of AWS Structural Welding Code, D.1.3, latest edition.

### 1.4 SUBMITTALS:

A. Manufacturer's Data: Submit copies of manufacturer's specifications and installation instructions for each

product as specified under Section 013000. Include manufacturer's certification as may be required to show compliance with these specifications. Furnish a copy of each instruction to the installer.

- B. Shop Drawings: Submit Shop Drawings as specified under Section 013000. Indicate decking plan, deck profile, dimensions, gage, anchorage, supports, projections, openings and reinforcement, finishes, applicable details and accessories, location and capacity of required deck shoring, type, locations and size of welds.
- 1.5 DELIVERY, STORAGE AND HANDLING:
  - A. General Contractor shall inspect all steel deck upon delivery to the site. Any damaged deck shall be rejected immediately and replaced. Store metal deck at the site above ground on platforms, skids or other supports with one end elevated for drainage. Cover deck until needed with a waterproof covering ventilated to prevent condensation.

# PART 2 - PRODUCTS

#### 2.1 MATERIALS:

- A. Sheet Steel: Conform to ASTM A653 Structural Quality with a minimum yield strength of 33,000 psi.
- B. Finish: All sheet steel shall have a light galvanized finish conforming to G60 requirements.
- C. Deck Units: Provide manufacturer's Standard Roll Form Deck Units of size and type shown on the drawings.
  - 1. Approved Deck Types:
    - a. Roof deck: Vulcraft 1.5B, gage as shown on drawings.
- D. Galvanized Touch-up Paint: Metallic zinc paint complying with ASTM A780.

#### 2.2 FABRICATION:

A. Form deck units in length to span four or more supports with flush, telescoped or nested two inch end laps and nested side laps. For composite deck, provide deformations required to structurally bond the fill material.

### 2.3 ACCESSORIES:

- A. Metal Closure Strips: Fabricate of galvanized sheet steel of same quality as deck units. Minimum thickness for roofs, 20 gauge, unless noted otherwise on drawings. Bend to provide tight fitting closures at open ends and sides of decking.
- B. Cover Plates: Fabricate of sheet steel of same quality as deck units, 18 gauge minimum thickness. Configuration to match contour of floor deck units.
- C. Welding Electrodes: AWS A5.1 or A5.5 to match the sheet steel used.
- D. Hanger Tabs and Clips: Not allowed.

#### PART 3 - EXECUTION

#### 3.1 INSPECTION:

A. Prior to start of installation, check all supporting members for correct layout and alignment and report all deviations from the Drawings to the Architect and General Contractor.

# 3.2 ERECTION:

- A. General: Install deck units and accessories in accordance with manufacturer's recommendations and Shop Drawings.
- B. Placing Deck Units: Position deck units on supporting members and adjust to final position with ends bearing on support and accurately aligned end to end before being permanently fastened. Provide roof deck end laps

of not less than two inches. Do not stretch or contract side lap interlocks. Place deck units flat and square, and secure to adjacent framing without warp or deflection.

- C. Cutting and Fitting: Cut and fit deck units and accessories around openings and projections through decking. Make cuts neat, square, and trim. Cut openings true to dimensions using metal saws, drills, or shears. Do not torch cut.
- D. Reinforcement at Openings:
  - 1. Provide reinforcing for all openings through metal deck as shown on the Drawings.
  - 2. Miscellaneous openings not shown on the Drawings, such as those required for vents, risers, conduits, etc., shall be cut and reinforced, if necessary, by the trade requiring the opening.
- E. Closure Strips: Install at all open, uncovered ends and edges of roof decking, and in voids between decking and other construction. Install flexible closure strips in accordance with manufacturer's instructions.

# 3.3 ROOF DECK INSTALLATION:

- A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter, but not less than 1-1/2 inches long. Unless shown otherwise on the drawings, fasten deck units as follows:
  - 1. Weld Diameter: 5/8 inch nominal.
  - 2. Minimum Weld Spacing: Weld panels at each support. Space welds 6 inches on center at end laps and at 12 inches on center at intermediate supports and at perimeter with a minimum of three welds per unit at each support.
- B. Unless otherwise shown on the drawings, fasten roof deck panels to concrete supporting members with 0.145" diameter powder actuated fasteners at 12" o.c. maximum.
- C. Side Lap Fastening: Unless indicated otherwise on the drawings, fasten side laps of panels between supports at intervals not exceeding 36 inches using self-drilling No. 10- diameter or larger galvanized steel screws.
- D. End Bearing: Install deck ends over supporting framing with a minimum end bearing of 1-1/2 inches, with end joints lapped 2 inches minimum.
- E. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's recommendations. Weld to substrate to provide a complete deck installation.

### 3.4 PROTECTION OF COMPLETED WORK:

- A. Do not use deck units for storage or as a working platform until permanently secured in position.
- B. The General Contractor shall assure that completed deck is not damaged by use as a runway, for storage of materials or subsequent work. Contractor shall assure that construction loads are not allowed which exceed the safe carrying capacity of the deck nor deform the shape of the deck.
- 3.5 FIELD QUALITY CONTROL:
  - A. Testing Agency: A qualified independent testing agency employed and paid by Owner will perform field quality-control testing.
  - B. Inspection:
    - 1. Visually inspect all metal deck to verify that all materials are in acceptable condition and have been properly installed.
    - 2. Visually inspect all deck welds prior to being covered by other work.
  - C. Testing agency will report test results promptly and in writing to Contractor and Architect.

- D. Remove and replace work that does not comply with specified requirements.
- E. Additional testing will be performed to determine compliance of corrected work with specified requirements.

# 3.6 REPAIRS AND PROTECTION:

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces with galvanized repair paint according to ASTM A780 and the manufacturer's instructions.

# 3.7 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Section 017419.

END OF SECTION 053000

### SECTION 054000 - COLD-FORMED METAL FRAMING

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Exterior non-load-bearing.
- B. Related Sections include the following:
  - 1. Division 09 Section "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Where member sizing are not shown, design of the members and connections shall be provided in accordance with this section.
- B. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
  - 1. Design Loads: As follows:
    - a. Wind Loads: As indicated in Design Criteria.
  - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
    - a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.
  - 3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
  - 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
    - a. Upward and downward movement of L/200 for roofs.
- C. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing General Provisions."
  - 1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing Header Design."
  - 2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

### 1.4 SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
  - 1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer registered in the State of Colorado responsible for their preparation.
- C. Welding certificates.
- D. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
  - 1. Vertical deflection clips.
  - 2. Horizontal drift deflection clips
  - 3. Stiff Clips

#### 1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.
- D. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- E. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- F. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing General Provisions."
  - 1. Comply with AISI's "Standard for Cold-Formed Steel Framing Header Design."
- G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

# 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

### PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Allied Studco.
  - 2. AllSteel Products, Inc.
  - 3. California Expanded Metal Products Company.
  - 4. Clark Steel Framing.
  - 5. Consolidated Fabricators Corp.; Building Products Division.
  - 6. Craco Metals Manufacturing, LLC.
  - 7. Custom Stud, Inc.
  - 8. Dale/Incor.
  - 9. Design Shapes in Steel.
  - 10. Dietrich Metal Framing; a Worthington Industries Company.
  - 11. Formetal Co. Inc. (The).
  - 12. Innovative Steel Systems.
  - 13. MarinoWare; a division of Ware Industries.
  - 14. Quail Run Building Materials, Inc.
  - 15. SCAFCO Corporation.
  - 16. Southeastern Stud & Components, Inc.
  - 17. Steel Construction Systems.
  - 18. Steeler, Inc.
  - 19. Super Stud Building Products, Inc.
  - 20. United Metal Products, Inc.

#### 2.2 MATERIALS

- A. Steel Sheet: ASTM A1003 / A1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
  - 1. Grade: ST33H, 33 ksi for studs 18 gauge and lighter. ST50H.
  - 2. Coating: G60 coating, or equivalent, except for sill tracks placed on slab-on-grade, provide G90.
- B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
  - 1. Grade: As required by structural performance.
  - 2. Coating: G90.
  - 3. Gauge: 14 gauge minimum.

### 2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0329 inch and as indicated.
  - 2. Minimum Flange Width: 1-5/8 inches and as indicated.
  - 3. Section Properties: As required.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, un-punched, with unstiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: Matching steel studs.
  - 2. Minimum Flange Width: 1-1/4 inches.

- C. Vertical Deflection Clips: Manufacturer's standard bypass and head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web. Maximum deflection of the clip/stud assembly under design load shall be the smaller of 1/8" or the elastic limit load.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dietrich Metal Framing; a Worthington Industries Company.
    - b. MarinoWare, a division of Ware Industries.
    - c. SCAFCO Corporation
    - d. The Steel Network, Inc.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; un-punched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows: Maximum track lateral deflection under design load shall not exceed 1/8" or the elastic limit load.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Minimum Base-Metal Thickness: Matching steel studs.
  - 3. Flange Width: 1 inch plus the design gap for 1-story structures.
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.
- F. Stiff Clips: Clip capable of supporting design loads indicated through positive mechanical attachment to the stud web. Maximum deflection of the clip/stud assembly under design loads shall be the smaller of 1/8" or the elastic limit load.

#### 2.4 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
  - 1. Supplementary framing.
  - 2. Bracing, bridging, and solid blocking.
  - 3. Web stiffeners.
  - 4. Anchor clips.
  - 5. End clips.
  - 6. Foundation clips.
  - 7. Gusset plates.
  - 8. Stud kickers, knee braces, and girts.
  - 9. Joist hangers and end closures.
  - 10. Hole reinforcing plates.
  - 11. Backer plates.

### 2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
  - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

### 2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, non-staining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multi-monomer plastic, non-leaching.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

### 2.7 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
  - 1. Fabricate framing assemblies using jigs or templates.
  - 2. Cut framing members by sawing or shearing; do not torch cut.
  - 3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
    - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
  - 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
  - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
  - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

#### PART 3 - EXECUTION

#### 3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Section 017419 – Construction Waste Management and Disposal.

#### 3.2 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.3 PREPARATION

- A. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- B. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

#### 3.4 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
  - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-toline joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
  - 1. Cut framing members by sawing or shearing; do not torch cut.
  - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

- a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation, where specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
  - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

# 3.5 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
  - 1. Maximum Stud Spacing: 16 inches.
- C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
  - 1. Connect vertical deflection clips to bypassing and infill studs and anchor to building structure.
  - 2. Connect drift clips to cold formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
  - 1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

### 3.6 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

#### 3.7 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed coldformed metal framing with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

#### 3.8 WASTE DISPOSAL

A. Construction Waste Management and Disposal: Manage construction waste in accordance with provisions of Section 017419

END OF SECTION 054000

### SECTION 055000 - METAL FABRICATIONS

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Miscellaneous steel framing and supports.
  - 2. Metal ladders.
  - 3. Miscellaneous steel trim.
  - 4. Metal bollards.
  - 5. Loose bearing and leveling plates.
- B. Products furnished, but not installed, under this Section:
  - 1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
  - 2. Steel weld plates and angles for casting into concrete.

### 1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design ladders, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
  - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

### 1.3 SUBMITTALS

- A. Product Data: For the following:
  - 1. Paint products.
  - 2. Grout.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
  - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

### PART 2 - PRODUCTS

- 2.1 METALS, GENERAL
  - A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

### 2.2 FERROUS METALS

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- E. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- F. Abrasive-Surface Floor Plate: (Not used)
- G. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- H. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
- I. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
  - 1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm); sized as required to support loading.
  - Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B structural steel, Grade 33 (Grade 230), with G90 (Z275) coating; 0.108-inch (2.8-mm) 0.079-inch (2-mm) 0.064inch (1.6-mm) nominal thickness.
  - 3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B structural steel, Grade 33 (Grade 230); 0.0966-inch (2.5-mm) 0.0677-inch (1.7-mm) 0.0528-inch (1.35-mm) minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.
- J. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M.

### 2.3 NONFERROUS METALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
- B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- C. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- D. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).
- E. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).
- F. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

### 2.4 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zincplated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls.
  - 1. Provide stainless-steel fasteners for fastening aluminum.
  - 2. Provide stainless-steel fasteners for fastening stainless steel.
  - 3. Provide stainless-steel fasteners for fastening nickel silver.
  - 4. Provide bronze fasteners for fastening bronze.
- B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
  - 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) Group 2 (A4) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- D. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

#### 2.5 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Division 09 painting Sections.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- F. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained concrete.

### 2.6 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
- C. Weld corners and seams continuously to comply with the following:

- 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
- 2. Obtain fusion without undercut or overlap.
- 3. Remove welding flux immediately.
- 4. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
- E. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 24 inches (600 mm) o.c.

### 2.7 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

### 2.8 METAL LADDERS

- A. General:
  - 1. Comply with ANSI A14.3 unless otherwise indicated.
- B. Steel Ladders:
  - 1. Location: Roof access to mechanical equipment; RE: Architectural drawings.
  - 2. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
  - 3. Siderails: Continuous, 1/2-by-2-1/2-inch (12.7-by-64-mm) steel flat bars, with eased edges.
  - 4. Rungs: Provide small hole Traction Tread by McNicols or equal. Provide three rows of holes each rung. Spacing 12 inches on center.
  - 5. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
  - 6. Provide nonslip abrasive surfaces on top of each rung.
  - 7. Provide steel walkthrough boarding rails and platform; platform deck to be 16 gauge Small Hole Traction Tread by McNichols or equal.
  - 8. Security Guard: Provide 6 foot height with continuous piano hinge and locking hasp.
  - 9. Prime exterior ladders, including brackets and fasteners, with zinc-rich primer.

# 2.9 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
- C. Galvanize exterior miscellaneous steel trim.
- D. Prime exterior miscellaneous steel trim with zinc-rich primer.

### 2.10 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
- B. Prime bollards with zinc-rich primer.

# 2.11 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

# 2.12 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

# 2.13 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

### 2.14 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  - 1. Shop prime with universal shop primer or primers specified in Division 09 painting Sections unless zinc-rich primer is indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
  - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 3. Items Indicated to Receive Primers Specified in Division 09 Section "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

### PART 3 - EXECUTION

### 3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Section 017419-Construction Waste Management and Disposal.

#### 3.2 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Construction Waste Management and Disposal.
  - 1. Manage construction waste in accordance with provisions of Section 017419-Construction Waste Management and Disposal.

#### 3.3 INSTALLING METAL BOLLARDS

- A. Anchor bollards in place on top of building concrete footings as shown on Structural Drawings. Level with shim and grout as necessary.
- B. Fill bollards solidly with concrete, mounding top surface to shed water.

### 3.4 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
- C. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

# 3.5 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

#### SECTION 055000 - METAL FABRICATIONS

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Miscellaneous steel framing and supports.
  - 2. Metal ladders.
  - 3. Miscellaneous steel trim.
  - 4. Metal bollards.
  - 5. Loose bearing and leveling plates.
- B. Products furnished, but not installed, under this Section:
  - 1. Loose steel lintels.
  - 2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
  - 3. Steel weld plates and angles for casting into concrete.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design ladders, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
  - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

## 1.3 SUBMITTALS

- A. Product Data: For the following:
  - 1. Paint products.
  - 2. Grout.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
  - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## PART 2 - PRODUCTS

## 2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

#### 2.2 FERROUS METALS

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- E. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- F. Abrasive-Surface Floor Plate: (Not used)
- G. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- H. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
- I. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
  - 1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm); sized as required to support loading.
  - Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B structural steel, Grade 33 (Grade 230), with G90 (Z275) coating; 0.108-inch (2.8-mm) 0.079-inch (2-mm) 0.064inch (1.6-mm) nominal thickness.
  - 3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B structural steel, Grade 33 (Grade 230); 0.0966-inch (2.5-mm) 0.0677-inch (1.7-mm) 0.0528-inch (1.35-mm) minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.
- J. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M.

## 2.3 NONFERROUS METALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
- B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- C. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- D. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).
- E. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).
- F. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

## 2.4 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zincplated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls.
  - 1. Provide stainless-steel fasteners for fastening aluminum.
  - 2. Provide stainless-steel fasteners for fastening stainless steel.
  - 3. Provide stainless-steel fasteners for fastening nickel silver.
  - 4. Provide bronze fasteners for fastening bronze.
- B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
  - Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) Group 2 (A4) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- D. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

## 2.5 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Division 09 painting Sections.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
- C. Epoxy Zinc-Rich Primer: (Not used)
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

## 2.6 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
- C. Weld corners and seams continuously to comply with the following:

- 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
- 2. Obtain fusion without undercut or overlap.
- 3. Remove welding flux immediately.
- 4. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
- E. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 24 inches (600 mm) o.c.

## 2.7 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
- C. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
  - 1. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.
- D. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.
- 2.8 PREFABRICATED BUILDING COLUMNS (Not used)
- 2.9 SHELF ANGLES (Not Used)
- 2.10 LADDER SAFETY CAGES (Not used)
- 2.11 METAL FLOOR PLATE (Not used)
- 2.12 STRUCTURAL-STEEL DOOR FRAMES (Not used)
- 2.13 MISCELLANEOUS STEEL TRIM
  - A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
  - B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

- C. Galvanize **exterior** miscellaneous steel trim.
- D. Prime exterior miscellaneous steel trim with zinc-rich primer.

## 2.14 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
  - 1. Cap bollards with 1/4-inch thick steel plate.
- B. Prime bollards with zinc-rich primer.
- 2.15 Pipe and Downspout Guards (Not used)
- 2.16 ABRASIVE METAL NOSINGS, TREADS, AND THRESHOLDS (Not used)
- 2.17 LOOSE BEARING AND LEVELING PLATES
  - A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- 2.18 LOOSE STEEL LINTELS (Not Used)

# 2.19 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.
- 2.20 FINISHES, GENERAL
  - A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - B. Finish metal fabrications after assembly.

## 2.21 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  - 1. Shop prime with universal shop primer or primers specified in Division 09 painting Sections unless zinc-rich primer is indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

- 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- 3. Items Indicated to Receive Primers Specified in Division 09 Section "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

#### PART 3 - EXECUTION

#### 3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Section 017419-Construction Waste Management and Disposal.

#### 3.2 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

A. Manage indoor air quality in accordance with provisions of Section 013100-Project Management and Coordination

## 3.3 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Construction Waste Management and Disposal.
  - 1. Manage construction waste in accordance with provisions of Section 017419-Construction Waste Management and Disposal.

#### 3.4 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
- B. Anchor bollards in place with concrete footings. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- C. Fill bollards solidly with concrete, mounding top surface to shed water.

#### 3.5 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
- C. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

## 3.6 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

## SECTION 061000 - ROUGH CARPENTRY

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Rooftop equipment bases and support curbs.
  - 2. Wood blocking and nailers.
  - 3. Plywood backing panels.

## 1.2 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.
  - 1. Include data for wood-preservative and fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.
- C. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
  - 1. Wood-preservative-treated wood.
  - 2. Fire-retardant-treated wood.
  - 3. Power-driven fasteners.
  - 4. Powder-actuated fasteners.
  - 5. Expansion anchors.

## 1.3 QUALITY ASSURANCE (Not Used)

## PART 2 - PRODUCTS

## 2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. Provide dressed lumber, S4S, unless otherwise indicated.

## 2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
  - 1. Wood nailers, equipment support bases, blocking and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

## 2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood).
  - 1. Use Exterior type for exterior locations and where indicated.
  - 2. Use Interior Type A, unless otherwise indicated.
- B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings, and the following:
  - 1. Concealed blocking.
  - 2. Plywood backing panels.
- 2.4 DIMENSION LUMBER FRAMING (Not Used)
- 2.5 ENGINEERED WOOD PRODUCTS (Not Used)

#### 2.6 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Rooftop equipment bases and support curbs.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.
- C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
  - 1. Mixed southern pine, No. 2 grade; SPIB.
  - 2. Eastern softwoods, No. 2 Common grade; NeLMA.

- 3. Northern species, No. 2 Common grade; NLGA.
- 4. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

#### 2.7 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exterior, AC, Exterior, C-C Plugged or Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

#### 2.8 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified.
  - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Power-Driven Fasteners: NES NER-272.
- C. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
- 2.9 METAL FRAMING ANCHORS (Not Used)

#### 2.10 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Self-adhesive, rubberized-asphalt compound, bonded to a high-density, polyethylene film to produce an overall thickness of not less than 0.025 inch (0.6 mm).

## PART 3 - EXECUTION

#### 3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Section 017419-Construction Waste Management and Disposal.

#### 3.2 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

A. Manage indoor air quality in accordance with provisions of Section 013100-Project Management and Coordination

#### 3.3 INSTALLATION

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking and similar supports to comply with requirements for attaching other construction.
- B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

- C. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- F. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
  - 3. Table 2305.2, "Fastening Schedule," in BOCA's BOCA National Building Code.
  - 4. Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code.

## 3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

## SECTION 061600 - SHEATHING

## PART 1 - GENERAL

#### 1.1 SUMMARY

- Α. This Section includes the following:
  - 1. Wall sheathing.

#### 1.2 **RELATED SECTIONS**

- Building paper. Reference Division 7 Section 072200-Weather Resistant Sheathing Paper. 1.
- 2.
- Building wrap. Reference Division 7 Section 072200-Weather Resistant Sheathing Paper. Sheathing joint-and-penetration treatment. Reference Division 7 Section 072200-Weather 3. Resistant Sheathing Paper.
- Flexible flashing at openings in sheathing. Reference Division 7 Section 072200-Weather 4. Resistant Sheathing Paper.

#### 1.3 SUBMITTALS

- Α. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - Include data for wood-preservative treatment from chemical treatment manufacturer and 1. certification by treating plant that treated plywood complies with requirements.
- Research/Evaluation Reports: For the following: Β.
  - 1. Preservative-treated plywood.

#### 1.4 QUALITY ASSURANCE (Not Used)

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Α. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

## PART 2 - PRODUCTS

- 2.1 WOOD PANEL PRODUCTS, GENERAL (Not Used)
- 2.2 PRESERVATIVE-TREATED PLYWOOD (Not Used)
- 2.3 FIRE-RETARDANT-TREATED PLYWOOD (Not Used)
- 2.4 WALL SHEATHING
  - A. Plywood Wall Sheathing: (Not Used)
  - B. Oriented-Strand-Board Wall Sheathing: (Not Used)
  - C. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
    - 1. Location: Behind metal wall panel.
    - 2. Type and Thickness: Regular, 5/8 inch thick.
- 2.5 ROOF SHEATHING (Not Used)
- 2.6 COMPOSITE NAIL BASE INSULATED ROOF SHEATHING (Not Used)
- 2.7 SUBFLOORING AND UNDERLAYMENT (Not Used)

## 2.8 FASTENERS

- A. General: Provide fasteners of size and type indicated.
  - 1. For wall and soffit sheathing panels, provide fasteners with corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

## 2.9 WEATHER-RESISTANT SHEATHING PAPER

- A. Reference Division 7 Section 072200-Weather Resistant Sheathing Paper.
- 2.10 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS
  - A. Reference Division 7 Section 072200-Weather Resistant Sheathing Paper.

## 2.11 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 and ASTM D 3498 that is approved for use indicated by manufacturers of both adhesives and panels.

- Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, 1. Subpart D (EPA Method 24).
- Β. Flexible Flashing:
  - 1. Reference Division 7 Section 072200-Weather Resistant Sheathing Paper.

## PART 3 - EXECUTION

- 3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
  - Α. Manage construction waste in accordance with provisions of Section 017419 - Construction Waste Management and Disposal.

#### 3.2 INSTALLATION, GENERAL

- Α. Securely attach to substrate by fastening as indicated, complying with the following:
  - NES NER-272 for power-driven fasteners. 1.
  - Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code." 2.
  - Table 2305.2, "Fastening Schedule," in BOCA's "BOCA National Building Code." Table 2306.1, "Fastening Schedule," in SBCCI's "Standard Building Code." 3.
  - 4.
- Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed Β. in sequence and manner that exclude exterior moisture.
- C. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- 3.3 WOOD SHEATHING INSTALLATION (Not Used)

#### 3.4 GYPSUM SHEATHING INSTALLATION

- Α. Comply with GA-253 and with manufacturer's written instructions.
  - Fasten gypsum sheathing to cold-formed metal framing with screws. 1.
  - 2. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
  - 3. Install boards with a 1/4-inch gap where they abut masonry or similar materials.

#### 3.5 FOAM-PLASTIC SHEATHING INSTALLATION (Not Used)

- 3.6 PARTICLEBOARD UNDERLAYMENT INSTALLATION (Not Used)
- HARDBOARD UNDERLAYMENT INSTALLATION (Not Used) 3.7
- 3.8 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION
  - Α. Reference Division 7 Section 072200-Weather Resistant Sheathing Paper.

## 3.9 SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Reference Division 7 Section 072200-Weather Resistant Sheathing Paper.

## 3.10 FLEXIBLE FLASHING INSTALLATION

A. Reference Division 7 Section 072200-Weather Resistant Sheathing Paper.

## 3.11 PROTECTION

A. Paper-Surfaced Gypsum Sheathing: Protect sheathing by covering exposed exterior surface of sheathing with weather-resistant sheathing paper securely fastened to framing. Apply covering immediately after sheathing is installed.

END OF SECTION 061600

## SECTION 072100 - THERMAL INSULATION

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Perimeter wall insulation (supporting backfill).
  - 2. Concealed building insulation.
  - 3. Vapor retarders.
  - 4. Sound attenuation insulation.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Plenum Rating: Provide glass and slag-wool-fiber/rock-wool-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
  - 1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm (13-m/s) air velocity.
  - 2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosium on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units for each type of exposed insulation indicated.
- C. Product test reports.

## 1.4 QUALITY ASSURANCE

- A. Retain ASTM test method below based on product and kind of fire-resistance characteristic specified for each product in Part 2. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84 for surface-burning characteristics and other methods indicated with product, by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
- B. Recycled Content: Provide glass and slag-wool-fiber/rock-wool-fiber insulation with recycled content so post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 10 percent and 20 percent of the cost of materials used for the Project.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- 2.2 FOAM-PLASTIC BOARD INSULATION (Not Used)
- 2.3 GLASS-FIBER BOARD INSULATION (Not Used)
- 2.4 SLAG-WOOL-FIBER/ROCK-WOOL-FIBER BOARD INSULATION (Not Used)
- 2.5 GLASS-FIBER BLANKET INSULATION
  - A. Manufacturers:
    - 1. CertainTeed Corporation.
    - 2. Guardian Fiberglass, Inc.
    - 3. Johns Manville.
    - 4. Owens Corning.
  - B. Unfaced and vinyl faced Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
  - C. Polypropylene-Scrim-Kraft-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type II (non-reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).
  - D. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:
    - 1. 3-1/2 inches thick with a thermal resistance of 13 deg F x h x sq. ft./Btu at 75 deg F.
    - 2. 5-1/2 inches thick with a thermal resistance of 19 deg F x h x sq. ft./Btu at 75 deg F.
    - 3. 10-1/4 inches thick with a thermal resistance of 30 deg F x h x sq. ft./Btu at 75 deg F.

- 2.6 SLAG-WOOL-FIBER/ROCK-WOOL-FIBER BLANKET INSULATION (Not Used)
- 2.7 LOOSE-FILL INSULATION (Not Used)
- 2.8 SPRAY-APPLIED CELLULOSIC INSULATION (Not Used)
- 2.9 VAPOR RETARDERS (Not Used)
- 2.10 AUXILIARY INSULATING MATERIALS (Not Used)

## 2.11 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate formed from perforated galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square, welded to projecting copper-coated steel spindle 0.105 inch (2.67 mm) in diameter and of length capable of holding insulation of thickness indicated securely in position with 1-1/2-inch- (38-mm-) square or diameter self-locking washers complying with the following requirements:
  - 1. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel sheet, with beveled edge for increased stiffness.
  - 2. Where anchors are located in ceiling plenums, protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap.
- B. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

## PART 3 - EXECUTION

#### 3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Section 017419-Construction Waste Management and Disposal.

## 3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

## 3.3 INSTALLATION OF PERIMETER INSULATION (Not Used)

3.4 INSTALLATION OF CAVITY-WALL INSULATION (Not Used)

## 3.5 INSTALLATION OF SPRAY-APPLIED CELLULOSE INSULATION (Not Used)

#### 3.6 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Set vapor-retarder-faced units with vapor retarder in crawlspace of construction, unless otherwise indicated.
  - 1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- D. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:
  - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
  - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures.
  - For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- E. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
  - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
  - 2. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
  - 3. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.
- F. Apply self-supported, spray-applied cellulosic insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make it flush with face of studs by using method recommended by insulation manufacturer.
- G. Stuff glass-fiber loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.

# 3.7 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION (Not Used)

# 3.8 INSTALLATION OF VAPOR RETARDERS (Not Used)

END OF SECTION 072100

## SECTION 072200 – WEATHER RESISTANT SHEATHING PAPER

## PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Building paper.
  - 2. Building wrap.
  - 3. Flexible flashing at openings in sheathing.

## 1.2 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
- B. Research/Evaluation Reports: For the following:
  - 1. Building wrap.
- 1.3 QUALITY ASSURANCE (Not Used)
- 1.4 DELIVERY, STORAGE, AND HANDLING
  - A. Provide for air circulation under coverings.
- PART 2 PRODUCTS

## 2.1 WEATHER-RESISTANT SHEATHING PAPER

- A. Building Paper: (Not used.)
- B. Building Wrap (Air Infiltration Barrier): ASTM E 1677, Type I air retarder; with flame-spread and smokedeveloped indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
  - 1. Location:
    - a. 1 layer behind metal wall panels.
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. DuPont (E. I. du Pont de Nemours and Company); Tyvek Commercial Wrap.
    - b. Or Approved Equal.

## 2.2 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing Board: Elastomeric silicone joint sealant recommended by sheathing manufacturer.
- B. Sealant for Glass-Mat Gypsum Sheathing Board: Silicone emulsion sealant complying with ASTM C 834, and recommended by tape and sheathing manufacturers.
- C. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, of type recommended by sheathing and tape manufacturers.

## 2.3 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Self-adhesive, rubberized-asphalt compound, bonded to a high-density, polyethylene film to produce an overall thickness of not less than 40 mils.

## PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Comply with manufacturer's installation guidelines and instructions, consistent with requirements of Project Specification and details on Drawings. Refer apparently conflicting requirements to Architect for clarification.
- B. Sequence: Coordinate with window and door installation.

## 3.2 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

- A. General: Cover sheathing with weather-resistant sheathing paper as follows:
  - 1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansionor control-joint locations.
  - 2. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap, unless otherwise indicated.
- B. Building Paper: (Not used)
- C. Building Wrap (Air Infiltration Barrier): Comply with manufacturer's written instructions.
  - 1. Secure air infiltration barrier with approved mechanical fasteners as recommended by manufacturer.
  - 2. Seal seams, edges, fasteners, and penetrations with tape.
  - 3. Extend into jambs of openings and seal corners with tape.
- D. Repair all accidental tears, damage or penetrations with Tyvek tape to form a leak free barrier.

#### 3.3 SHEATHING JOINT-AND-PENETRATION TREATMENT

- A. Seal sheathing joints according to sheathing manufacturer's written instructions.
  - 1. Apply elastomeric sealant to joints and fasteners and trowel flat. Seal other penetrations and openings.

- 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed tape in sealant. Apply sealant to exposed fasteners. Seal other penetrations and openings.
- 3. Apply sheathing tape to joints at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

## 3.4 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturers written instructions.
  - 1. Lap seams and junctures with other materials at least 4 inches (100 mm).
  - 2. Lap flexible flashing over weather-resistant building paper and building wrap at bottom and sides of openings.
  - 3. Lap weather-resistant building paper and building wrap over flexible flashing at heads of openings.
  - 4. After flashing has been applied, roll surfaces with a hard rubber or metal roller.

## END OF SECTION 061600

## SECTION 074213 - METAL WALL PANELS

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Exposed-fastener, lap-seam metal wall panels.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Air Infiltration: Maximum 0.06 cfm/sf (0.3 L/s per sq. m) per ASTM E 283 at a static-air-pressure difference of 6.24 lbf/sf (300 Pa), using minimum 10 feet by 10 feet test panel that includes horizontal and vertical joints.
- C. Water Penetration Dynamic Testing: No uncontrolled water penetration per AAMA 501.1 at a minimum pressure differential of 15 lb/sf (.72 kPa) using a minimum 10 feet by 10 feet test panel.
- D. Horizontal Panel Joint Performance Static test per ASTM E 331 with horizontal seals removed 1 inch in 10 feet lengths to simulate seal defects. No uncontrolled water penetration permitted at a pressure of 15 lb/sf (.90 kPa).
- E. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.
- F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-upliftresistance class indicated.
  - 1. Uplift Rating: UL 90.
- G. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:
  - 1. Wind Loads: Determine loads based on the following minimum design wind pressures:
    - a. Uniform pressure of 30 lbf/sq. ft. (1436 Pa), acting inward or outward.
  - 2. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/180 of the span.

## 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop- and field-assembled work.
- C. Samples: For each type of exposed finish required.

- D. Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wallmounted items.
- F. Product test reports.
- G. Maintenance data.
- H. Warranties: Samples of special warranties.

## 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Preinstallation Conference: Conduct conference at Project site.

## 1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Finish Warranty Period: 20 years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 PANEL MATERIALS

- A. Recycled Content: Minimum 25 percent post-consumer recycled content.
- B. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A 755/A 755M.
  - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
  - 2. Surface: Smooth, flat finish.
  - 3. Exposed Coil-Coated Finish:
    - a. 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
  - 4. Concealed Finish: Manufacturer's standard white or light-colored acrylic or polyester backer finish.
- C. Panel Sealants:

- 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- 2. Joint Sealant: ASTM C 920 as recommended in writing by metal wall panel manufacturer.
- 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

## 2.2 FIELD-INSTALLED THERMAL INSULATION

A. Refer to Division 07 Section "Thermal Insulation."

## 2.3 WEATHER-RESISTANT SHEATHING PAPER

A. Refer to Division 07 Section "Weather-Resistant Sheathing Paper."

#### 2.4 MISCELLANEOUS METAL FRAMING

- A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.
- B. Base or Sill Angles: 0.079-inch (2.01-mm) nominal thickness.

#### 2.5 MISCELLANEOUS MATERIALS

A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

#### 2.6 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. Provide factory-formed metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide Berridge Manufacturing Company, Straight "S" Deck or comparable product by one of the following:
    - a. AEP-Span.
    - b. ATAS International, Inc.
    - c. CENTRIA Architectural Systems.
    - d. Copper Sales, Inc.
    - e. Englert, Inc.
  - 3. Profile: Corrugated.
  - 4. Material: Zinc-coated (galvanized) steel sheet, 24-gauge nominal thickness.
    - a. Exterior Finish: 2-coat fluoropolymer.
    - b. Color: As selected by Architect from manufacturer's full range.
  - 5. Panel Coverage: 34-5/8 inch (874 mm) nominal overall panel width.
  - 6. Corrugation Spacing: 2-1/2 inches on center.
  - 7. Panel Height: 7/8 inch.

## 2.7 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS (Not Used)

## 2.8 METAL LINER PANELS (Not Used)

## 2.9 METAL SOFFIT PANELS (Not Used)

#### 2.10 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
  - 1. Closures: Fabricated of same metal as metal wall panels.
  - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
  - Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closedcell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Formed from 0.018-inch (0.46-mm) minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

#### 2.11 FABRICATION

- A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.
- E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

## PART 3 - EXECUTION

## 3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Section 017419.

## 3.2 PREPARATION

A. Miscellaneous Framing: Install base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

## 3.3 THERMAL INSULATION INSTALLATION (Not Used)

## 3.4 METAL WALL PANEL INSTALLATION

- A. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
  - 1. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
  - 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall panels.
  - 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
  - 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
  - 5. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
  - 6. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps; on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weathertight.
  - 7. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
- B. Metal Soffit Panels: (Not Used)

## 3.5 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
  - 1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

## 3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

END OF SECTION 074213

## SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Adhered TPO membrane roofing system.

## 1.2 PERFORMANCE REQUIREMENTS

A. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

## 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Verification: For the following products:
  - 1. Sheet roofing, of color specified.
  - 2. Roof paver in each color and texture required.
- D. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
  - 1. Submit evidence of compliance with performance requirements.
- E. Research/evaluation reports.
- F. Field quality-control reports.
- G. Maintenance data.

## 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product.
- B. Source Limitations: Obtain components including roof insulation and fasteners for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
- C. Exterior Fire-Test Exposure: ASTM E 108, Class C; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
- D. Preinstallation Roofing Conference: Conduct conference at Project site.

## 1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 15 years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 ADHESIVES & SEALANTS (EQc4.1)

A. Adhesives and Sealants in this section must comply with South Coast Air Quality Management District Rule 1168 and Green Seal Standard GS-36.

## 2.2 TPO MEMBRANE ROOFING

- A. Recycled Content: Minimum 5 percent (5%) total recycled content.
- B. Fabric-Reinforced Thermoplastic Polyolefin Sheet: ASTM D 6878, internally fabric or scrim reinforced, uniform, flexible TPO sheet.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Carlisle SynTec Incorporated.
    - b. Firestone Building Products Company.
    - c. GAF Materials Corporation.
    - d. GenFlex Roofing Systems.
    - e. Johns Manville.
    - f. Mule-Hide Products Co., Inc.
    - g. Versico Incorporated.
  - 2. Thickness: 60 mils (1.5 mm), nominal.
  - 3. Color: White.

## 2.3 AUXILIARY MEMBRANE ROOFING MATERIALS

- A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.
  - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
  - Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
    - a. Plastic Foam Adhesives: 50 g/L.
    - b. Gypsum Board and Panel Adhesives: 50 g/L.
    - c. Multipurpose Construction Adhesives: 70 g/L.
    - d. Fiberglass Adhesives: 80 g/L.
    - e. Contact Adhesive: 80 g/L.
    - f. Single-Ply Roof Membrane Sealants: 450 g/L.
    - g. Nonmembrane Roof Sealants: 300 g/L.
    - h. Sealant Primers for Nonporous Substrates: 250 g/L.
    - i. Sealant Primers for Porous Substrates: 775 g/L.

- B. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as sheet membrane.
- C. Bonding Adhesive: Manufacturer's standard, water based.
- D. Slip Sheet: Manufacturer's standard, of thickness required for application.
- E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
- F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

## 2.4 SUBSTRATE BOARDS

- A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch (13 mm) thick.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

## 2.5 ROOF INSULATION

- A. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
- B. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.
- C. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

## 2.6 INSULATION ACCESSORIES

- A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- B. Insulation Adhesive: Insulation manufacturer's recommended cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.

## 2.7 ASPHALT MATERIALS

- A. Roofing Asphalt: ASTM D 312, Type III or Type IV, ASTM D 6152, SEBS modified.
- B. Asphalt Primer: ASTM D 41.

## 2.8 AGGREGATE BALLAST (Not Used)

2.9 ROOF PAVERS (Not Used)

#### 2.10 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.

## PART 3 - EXECUTION

#### 3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

- A. Manage construction waste in accordance with provisions of Section 017419-Construction Waste Management and Disposal.
- 3.2 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT
  - A. Manage indoor air quality in accordance with provisions of Section 013100-Project Management and Coordination
- 3.3 SUBSTRATE BOARD (Not Used)

#### 3.4 INSULATION INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
- E. Mechanically Fastened and Adhered Insulation: Install each layer of insulation and secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
  - 1. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
  - 2. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
  - 3. Set each subsequent layer of insulation in adhesive, firmly pressing and maintaining insulation in place.
- F. Install slip sheet over insulation and immediately beneath membrane roofing.

## 3.5 ADHERED MEMBRANE ROOFING INSTALLATION

- A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.
- B. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- C. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.
- D. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.
- E. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
- F. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
  - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
  - 2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
  - 3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

#### 3.6 MECHANICALLY FASTENED MEMBRANE ROOFING INSTALLATION (Not Used)

3.7 LOOSELY LAID AND BALLASTED MEMBRANE ROOFING INSTALLATION (Not Used)

## 3.8 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

#### 3.9 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

## 3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- C. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

END OF SECTION 075423

## SECTION 076200 - SHEET METAL FLASHING AND TRIM

## PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Formed low-slope roof flashing and trim.
  - 2. Formed wall flashing and trim.

#### 1.2 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Shop Drawings: Show layouts, profiles, shapes, seams, dimensions, and details for fastening, joining, supporting, and anchoring sheet metal flashing and trim.
- C. Samples: For each type of sheet metal flashing and trim.

#### 1.3 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- B. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  - 1. Build mockup of typical roof parapet and fascia, approximately 48 inches (1200 mm) long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
  - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Pre-installation Conference: Conduct conference at Project site.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

## 2.2 SHEET METALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:

- 1. Clear Anodic Finish: Class II, AA-M12C22A31, complying with AAMA 611.
- B. Pre-painted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
  - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
  - 2. Exposed Finishes: Apply the following coil coating:
    - a. Factory Prime Coating: Factory-applied, baked-on epoxy primer coat.
    - b. High-Performance Organic Finish: Two-coat thermocured system containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2604, except as modified for below:
      - 1) Humidity and Salt Spray Resistance: 1000 hours.
      - 2) Color: As selected by Architect from manufacturer's full range.

### 2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slipresisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
  - 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
  - 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).

### 2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
  - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
    - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factoryapplied coating.
    - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
    - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
  - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
  - 3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.
- C. Solder:
  - 1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

- D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape.
- E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound.
- H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat.
- 2.5 REGLETS (Not Used)

### 2.6 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
- B. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
  - 1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
  - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- C. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- D. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
- E. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal, and in thickness not less than that of metal being secured.

#### 2.7 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
  - 1. Hanger Style: SMACNA Figure 1-35J.
  - 2. Fabricate from the following materials:
    - a. Galvanized Steel: 0.022 inch (0.56 mm) thick (24 gage).

### 2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing: Fabricate in minimum <u>96-inch-</u> (2400-mm-) long, but not exceeding <u>10-foot-</u> (3-m-) long, sections. Furnish with <u>6-inch-</u> (150-mm-) wide joint cover plates.
  - 1. Galvanized Steel: 0.028 inch (0.71 mm) thick (22 gage).
- B. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
  - 1. Fabricate copings from the following material:
    - a. Pre-painted, Metallic-Coated Steel, 0.040 inch (1.02 mm) thick (20 gage).
- C. Base Flashing: Fabricate from the following material:
  - 1. Pre-painted, Metallic-Coated Steel: 0.0276 inch (0.7 mm) thick (22 gage).
- D. Counterflashing and Flashing Receivers: Fabricate from the following material:
  - 1. Prepainted, Metallic-Coated Steel: 0.0217 inch (0.55 mm) thick (24 gage).
- E. Roof-Penetration Flashing: Fabricate from the following material:
  - 1. Pre-painted, Metallic-Coated Steel: 0.0276 inch (0.7 mm) thick (22 gage).
- F. Roof-Drain Flashing: Fabricate from the following material:
  - 1. Stainless Steel: 0.0156 inch (0.4 mm) thick (28 gage).
- 2.9 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS (Not Used)

### 2.10 WALL SHEET METAL FABRICATIONS

- A. Openings Flashing in Frame Construction: Fabricate head, sill, and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high end dams. Fabricate from the following material:
  - 1. Aluminum: 0.0320 inch (0.8 mm) thick (20 gage).

#### PART 3 - EXECUTION

- 3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
  - A. Manage construction waste in accordance with provisions of Section 017419-Construction Waste Management and Disposal.
- 3.2 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT
  - A. Manage indoor air quality in accordance with provisions of Section 013100-Project Management and Coordination

## 3.3 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

## 3.4 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement so that completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  - 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
  - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
  - 3. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
  - 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
  - 5. Install sealant tape where indicated.
  - 6. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
  - 1. Coat back side of uncoated aluminum sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
  - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of self-adhered sheet underlayment or felt underlayment and cover with a slip sheet.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and butyl sealant.
- E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
  - 1. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
  - 1. Coping Expansion Seams: Provide SMACNA Figure 3-2, Detail 4 drive cleat or lock.
- G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
  - 1. Galvanized or Pre-painted, Metallic-Coated Steel: Use stainless-steel fasteners.

- 2. Aluminum: Use aluminum or stainless-steel fasteners.
- H. Seal joints with butyl sealant as required for watertight construction.
- I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm) except where pre-tinned surface would show in finished Work.
  - 1. Do not solder pre-painted, metallic-coated steel and aluminum sheet.

### 3.5 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.
- C. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches (100 mm) in direction of water flow.

## 3.6 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch (75-mm) centers.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49.
  - 1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 16-inch (400-mm) centers.
    - a. Coping Edge Style: SMACNA, Page 3.4, Edge Style E2.
  - 2. Anchor interior leg of coping with screw fasteners and washers at 18-inch (450-mm) centers.
- D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Secure in a waterproof manner. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with butyl sealant.
- E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
  - 1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
  - 2. Seal with butyl sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

## 3.7 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Openings Flashing in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

### 3.8 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 076200

# SECTION 077100 - ROOF SPECIALTIES

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section Includes:
  - 1. Copings.
  - 2. Roof-edge flashings.
  - 3. Roof-edge drainage systems.
  - 4. Reglets and counterflashings.

### 1.2 PERFORMANCE REQUIREMENTS

- A. SPRI Wind Design Standard: Manufacture and install copings and roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:
  - 1. Design Pressure: As indicated on Drawings.

# 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Product test reports.
- E. Maintenance data.
- F. Warranty: Sample of special warranty.

#### 1.4 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

#### 1.5 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 EXPOSED METALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.
  - 1. Surface: Smooth, flat finish.
  - 2. Exposed Coil-Coated Finishes: Prepainted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    - a. Two-Coat Fluoropolymer: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

### 2.2 CONCEALED METALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.

### 2.3 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- B. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
  - 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
  - 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
- C. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

### 2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
  - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
  - 2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinccoated steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## 2.5 COPINGS

- A. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as coping caps.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Architectural Products Company.
    - b. ATAS International, Inc.
    - c. Castle Metal Products.
    - d. Cheney Flashing Company.
    - e. Hickman Company, W. P.
    - f. Johns Manville.
    - g. Merchant & Evans, Inc.
    - h. Metal-Era, Inc.
    - i. Metal-Fab Manufacturing, LLC.
    - j. MM Systems Corporation.
    - k. National Sheet Metal Systems, Inc.
    - I. Perimeter Systems; a division of Southern Aluminum Finishing Company, Inc.
    - m. Petersen Aluminum Corporation.
  - 2. Coping-Cap Material: Zinc-coated steel, nominal thickness as required to meet performance requirements.
    - a. Finish: Two-coat fluoropolymer.
    - b. Color: As selected by Architect from manufacturer's full range.
  - 3. Corners: Factory mitered and mechanically clinched and sealed watertight.
  - 4. Special Fabrications: (Not Used).
  - 5. Coping-Cap Attachment Method: Face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.
  - 6. Face Leg Cleats: Concealed, continuous galvanized-steel sheet.
- 2.6 ROOF-EDGE FLASHINGS
  - A. Canted Roof-Edge (Not Used)
  - B. Roof-Edge Fascia: (Not Used)
  - C. One-Piece Gravel Stops: Manufactured, one-piece, metal gravel stop in section lengths not exceeding 12 feet, with a horizontal flange and vertical leg fascia terminating in a drip edge, and concealed splice plates of same material, finish, and shape as gravel stop. Provide matching corner units.
    - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - a. Architectural Products Company.
      - b. Berger Building Products, Inc.
      - c. Castle Metal Products.
      - d. Cheney Flashing Company.
      - e. Hickman Company, W. P.
      - f. Metal-Era, Inc.
      - g. Metal-Fab Manufacturing, LLC.
      - h. MM Systems Corporation.
      - i. National Sheet Metal Systems, Inc.
      - j. Perimeter Systems; a division of Southern Aluminum Finishing Company, Inc.
      - k. Petersen Aluminum Corporation.

- 2. Fabricate from the following exposed metal:
  - a. Zinc-Coated Steel: Nominal thickness as required to meet performance requirements.
- 3. Corners: Factory mitered and mechanically clinched and sealed watertight.
- D. Zinc-Coated Steel Finish: Two-coat fluoropolymer.
  - 1. Color: As selected by Architect from manufacturer's full range.

## 2.7 ROOF-EDGE DRAINAGE SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Andreas Renner KG.
  - 2. Architectural Products Company.
  - 3. ATAS International, Inc.
  - 4. Berger Building Products, Inc.
  - 5. Castle Metal Products.
  - 6. Cheney Flashing Company.
  - 7. CopperCraft by FABRAL; a Euramax company.
  - 8. Hickman Company, W. P.
  - 9. Klauer Manufacturing Company.
  - 10. Merchant & Evans, Inc.
  - 11. Metal-Era, Inc.
  - 12. Metal-Fab Manufacturing, LLC.
  - 13. MM Systems Corporation.
  - 14. National Sheet Metal Systems, Inc.
  - 15. Perimeter Systems; a division of Southern Aluminum Finishing Company, Inc.
- B. Gutters: (Not Used)
- C. Downspouts: Open-face rectangular complete with mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
   1. Zinc-Coated Steel: Nominal 0.034-inch thickness.
- D. Parapet Scuppers: Manufactured with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof.
  - 1. Fabricate from the following exposed metal:
    - a. Zinc-Coated Steel: Nominal 0.028-inch thickness.
- E. Conductor Heads: Manufactured conductor heads, each with flanged back and stiffened top edge and of dimensions and shape indicated, complete with outlet tube that nests into upper end of downspout, exterior flange trim, and built-in overflow.
  - 1. Fabricate from the following exposed metal:
    - a. Zinc-Coated Steel: Nominal 0.028-inch thickness.
- F. Zinc-Coated Steel Finish: Two-coat fluoropolymer.
  - 1. Color: As selected by Architect from manufacturer's full range.

## 2.8 REGLETS AND COUNTERFLASHINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Castle Metal Products.
  - 2. Cheney Flashing Company.
  - 3. Fry Reglet Corporation.
  - 4. Heckmann Building Products Inc.
  - 5. Hickman Company, W. P.
  - 6. Keystone Flashing Company, Inc.
  - 7. Metal-Era, Inc.
  - 8. Metal-Fab Manufacturing, LLC.
  - 9. MM Systems Corporation.
  - 10. National Sheet Metal Systems, Inc.
- B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
  - 1. Zinc-Coated Steel: Nominal 0.028-inch thickness.
  - 2. Corners: Factory mitered and mechanically clinched and sealed watertight.
  - 3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
  - 4. Stucco Type, Embedded: Provide reglets with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
  - 5. Concrete Type, Embedded: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
  - 6. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.
  - 7. Multiuse Type, Embedded: For multiuse embedment in cast-in-place concrete and masonry mortar joints.
- C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:
  - 1. Zinc-Coated Steel: Nominal 0.028-inch thickness.
- D. Accessories:
  - 1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
  - 2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
- E. Zinc-Coated Steel Finish: Two-coat fluoropolymer.
  - 1. Color: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

## 3.1 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.
  - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
  - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
  - 3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
  - 4. Torch cutting of roof specialties is not permitted.
  - 5. Install underlayment with adhesive for temporary anchorage. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches. Roll laps of self-adhering sheet underlayment with roller; cover within 14 days.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
  - 1. Coat concealed side of uncoated aluminum and stainless-steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
  - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or self-adhering high-temperature sheet underlayment.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
  - 1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise shown on Drawings.
  - 2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints with sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches except reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

# 3.2 COPING INSTALLATION

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings to meet performance requirements.

1. Interlock face leg drip edge into continuous cleat anchored to substrate at manufacturer's required spacing that meets performance requirements. Anchor back leg of coping with screw fasteners and elastomeric washers at manufacturer's required spacing that meets performance requirements.

## 3.3 ROOF-EDGE FLASHING INSTALLATION

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

## 3.4 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions.
- B. Gutters: (Not Used)
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
- D. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
- E. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch below scupper discharge.

# 3.5 REGLET AND COUNTERFLASHING INSTALLATION

- A. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.
- B. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Fit counterflashings tightly to base flashings.

## 3.6 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed.

# END OF SECTION 077100

### SECTION 079200 - JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
  - 1. Silicone joint sealants.
  - 2. Urethane joint sealants.
  - 3. Latex joint sealants.
  - 4. Acoustical joint sealants.
- B. See Division 32 Section "Concrete Paving Joint Sealants" for sealing joints in pavements, walkways, and curbing.

## 1.2 PRECONSTRUCTION TESTING

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers eight samples of materials that will contact or affect joint sealants. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

#### 1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.
  - 3. Joint-sealant formulation.
  - 4. Joint-sealant color.
- D. Preconstruction field test reports.

- E. Compatibility and adhesion test reports.
- F. Product certificates and test reports.

## 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.
- B. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
- C. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates according to the method in ASTM C 1193 that is appropriate for the types of Project joints.
- D. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
  - 1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.
- E. Preinstallation Conference: Conduct conference at Project site.

## 1.6 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: two years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

## 2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

- B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
  - 1. Sealants: 250 g/L.
  - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
  - 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

## 2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

## 2.4 SILICONE JOINT SEALANTS

- A. Mildew-Resistant Silicone Joint Sealant: ASTM C 920.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF Building Systems.
    - b. Dow Corning Corporation.
    - c. GE Advanced Materials Silicones.
    - d. May National Associates, Inc.
    - e. Pecora Corporation.
    - f. Polymeric Systems, Inc.
    - g. Schnee-Morehead, Inc.
    - h. Sika Corporation; Construction Products Division.
    - i. Tremco Incorporated.
  - 2. Type: Single component (S) or multicomponent (M).
  - 3. Grade: Pourable (P) or nonsag (NS).
  - 4. Class: 25.
  - 5. Uses Related to Exposure: Traffic (T) and Nontraffic (NT).

# 2.5 URETHANE JOINT SEALANTS

- A. Urethane Joint Sealant: ASTM C 920.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF Building Systems.
    - b. Bostik, Inc.
    - c. Lymtal, International, Inc.
    - d. May National Associates, Inc.
    - e. Pacific Polymers International, Inc.
    - f. Pecora Corporation.
    - g. Polymeric Systems, Inc.

- h. Schnee-Morehead, Inc.
- i. Sika Corporation; Construction Products Division.
- j. Tremco Incorporated.
- 2. Type: Single component (S) or multicomponent (M).
- 3. Grade: Pourable (P) or nonsag (NS).
- 4. Class: 25.
- 5. Uses Related to Exposure: Traffic (T) and Nontraffic (NT).

#### 2.6 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF Building Systems.
    - b. Bostik, Inc.
    - c. May National Associates, Inc.
    - d. Pecora Corporation.
    - e. Schnee-Morehead, Inc.
    - f. Tremco Incorporated.

### 2.7 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type **C** (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

## 2.8 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Section 017419-Construction Waste Management and Disposal.

### 3.2 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

A. Manage indoor air quality in accordance with provisions of Section 013100-Project Management and Coordination

### 3.3 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.
    - a. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
  - 2. Remove laitance and form-release agents from concrete.
    - a. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with jointsealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

## 3.4 INSTALLATION

- A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- B. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
- G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

# 3.5 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
  - 1. Extent of Testing: Test completed and cured sealant joints as follows:
    - a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
    - b. Perform 1 test for each 1000 feet (300 m) of joint length thereafter or 1 test per each floor per elevation.
  - 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

# 3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
  - 1. Joint Locations:
    - a. Isolation and contraction joints in cast-in-place concrete slabs.
    - b. Other joints as indicated.
  - 2. Joint Sealant: Urethane.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal non-traffic surfaces.

- 1. Joint Locations:
  - a. Construction joints in cast-in-place concrete.
  - b. Control and expansion joints in unit masonry.
  - c. Joints between metal panels.
  - d. Joints between different materials listed above.
  - e. Perimeter joints between materials listed above and frames of doors, windows and louvers.
  - f. Control and expansion joints in ceilings and other overhead surfaces.
  - g. Other joints as indicated.
- 2. Joint Sealant: Urethane.
- 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
  - 1. Joint Locations:
    - a. Isolation joints in cast-in-place concrete slabs.
    - b. Other joints as indicated.
  - 2. Joint Sealant: Silicone.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal non-traffic surfaces.
  - 1. Joint Locations:
    - a. Control and expansion joints on exposed interior surfaces of exterior walls.
    - b. Perimeter joints of exterior openings where indicated.
    - c. Vertical joints on exposed surfaces of interior unit masonry walls and partitions.
    - d. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
    - e. Other joints as indicated.
  - 2. Joint Sealant: Latex.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
  - 1. Joint Sealant Location:
    - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - b. Tile control and expansion joints where indicated.
    - c. Other joints as indicated.
  - 2. Joint Sealant: Silicone.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal non-traffic surfaces.
  - 1. Joint Location:
    - a. Acoustical joints where indicated.
    - b. Other joints as indicated.
  - 2. Joint Sealant: Acoustical.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 079200

# SECTION 079500 - EXPANSION CONTROL

PART 1 - GENERAL

# 1.1 SUMMARY:

- A. Work included:
  - 1. Roof expansion joint covers
  - 2. Exterior wall expansion joint covers
- B. Related work specified elsewhere includes:
  - 1. Cast-in-place concrete
  - 2. Sealants and caulking

# 1.2 REFERENCES:

COORDINATE REFERENCE SELECTION WITH MATERIAL SELECTION IN PART TWO.

A. Reference standards; as referenced herein1. American Society for Testing and Materials (ASTM)

# **1.3 SYSTEM DESCRIPTION:**

- A. Joint cover systems shall allow unrestrained movement of joint without disengagement of cover.
- B. Joint size/movement range: As indicated on drawings.

# 1.4 SUBMITTALS:

- A. Product data: Submit manufacturer's product description indicating compliance with specified requirements. Include installation instructions for each type of expansion control material.
- B. Shop drawings: Submit detailed shop drawings for expansion control conditions. \*\* Include requirements for blockouts. Submit prior to concrete placement or other construction adjacent to expansion joints.
- C. Samples: Submit one 6" sample of each specified system style.

# 1.5 QUALITY ASSURANCE:

- A. Manufacturer: Furnish assemblies from one manufacturer with a minimum of five years experience in the design and fabrication of expansion joint cover assemblies.
- B. Installer: Firm with a minimum of five years experience in installation of systems similar to those required by this project and acceptable to manufacturer.

# 1.6 PROJECT/SITE CONDITIONS:

- A. Deliver joint covers to jobsite in new, clean, unopened containers of size and strength to protect materials during shipping.
- B. Store materials in original containers in dry location.

# 1.7 WARRANTY:

- A. Provide manufacturer's standard one-year material and workmanship warranty.
- B. Finish warranty: Warrant fluoropolymer coating to remain free, under normal atmospheric conditions, from peeling, checking, cracking, chalking in excess of numerical rating of 8 when measured in accord with ASTM D4214, of fading in excess of 5 NBS (ASTM D2244) units during warranty period. Warranty period shall be 20 years.
- C. Warranties shall begin at Date of Substantial Completion.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURER:

- A. MM Systems Corporation, 50 MM WAY, PENDERGRASS, Georgia 30567; 1-800-241-3460 or 706-824-7501
- B. Expansion control systems of similar design and construction, as manufactured by other manufacturers, may be submitted for Architect's consideration. Acceptance is subject to compliance with specified design criteria, as evidenced by submittal of specified product data. Submittals shall comply with requirements of Product Options and Substitutions section.

# 2.2 MATERIALS:

- A. Aluminum: Alloys meeting ASTM B221-95a
  - 1. Extrusions: 6063-T5 and 6005-T5 alloys
  - 2. Plates: 6061-T6 alloy
  - 3. Sheet: 5052-H32 alloy

# B. Bronze:

- 1. Extrusions: CDA Alloy C385, Architectural Bronze
- 2. Sheet: CDA Alloy C28000, Muntz Metal and C46400 Navel Brass
- 3. Tube, pipe and strip: Half hard brass, UNS, Alloy C26000 (CDA Alloy 260, Cartridge Brass).
- C. Stainless steel: AISI Type 302/304, 2B finish
- D. Visual seal: System manufacturer's standard elastomeric seal. Color as selected by Architect from manufacturer's standard selection range.
- E. Elastomeric seals: Color shall be as selected by Architect from manufacturer's standard color range. Custom color as selected by Architect.
- F. Fire barrier material: In accord with test reports and listing agency requirements.

# 2.3 EXTERIOR WALL SYSTEMS:

- A. Acceptable products:
  - 1. SIF Series at wall/wall conditions.
- B. Characteristics:
  - 1. Frame material: Extruded aluminum.
  - 2. Visual seal: Silicone. Color shall be black.
  - 3. Pantograph: Stainless steel, spaced as necessary to comply with wind load conditions.
  - 4. Weather seal: Continuous elastomeric sheet

# 2.4 EXTERIOR ROOF SYSTEMS:

- A. Acceptable products:
  - 1. ERFL Series at roof/wall conditions.
- B. Characteristics:
  - 1. Description: Prefabricated flexible elastomeric insulated black foam bellows and galvanized steel nailing flanges.
  - 2. Provide factory-fabricated corner, tee, and crossover transition and termination sections as necessary.
  - 3. Splicing accessories:
    - a. Adhesive: Manufacturer's recommended splicing adhesive.
    - b. Splicing sheet: Sheet material furnished by expansion cover manufacturer.

# 2.5 FABRICATION:

- A. Factory fabricates expansion joint components to greatest extent practicable. Manufacturer, based on minimum and maximum size of joints indicated, shall determine size of joint components.
- B. Fabricate units in single length without intermediate joints where practicable.

# PART 3 - EXECUTION

# 3.1 SURFACE PREPARATION:

- A. Prepare surfaces to receive expansion joint systems in accordance with manufacturer's product data and approved shop drawings.
- B. Clean surfaces adjacent to and including joints prior to installation. Repair surfaces as required to provide a smooth, even sound surface. Surfaces shall be free of debris, oils, dust or other deleterious materials.
- C. Install blockouts for expansion joint systems in accordance with approved shop drawings and manufacturer's product data. Coordinate installation of blockouts with cast-in-place concrete work.
- D. Shim only as approved by manufacturer.

# 3.2 APPLICATION:

- A. Install manufactured expansion control assemblies in accordance with approved shop drawings and manufacturer's product data, except where more stringent requirements are specified herein. Cover and protect expansion joint cover assemblies from construction traffic.
- B. Fire-rated systems: Install fire-resistant barriers in conjunction with expansion joint covers to achieve the specified fire rated system in accordance with manufacturer's fire barrier product data or installation instructions.
- C. Heavy-duty traffic joints:
  - 1. Blockouts shall be smooth level and sound. Do not shim heavy-duty traffic joints.
  - 2. Mechanically fasten each side of frame to blockouts in substrates; top edges of frames shall be flush with adjacent surfaces.
  - 3. Install expansion plate and bolt frame cover to frames.
  - 4. Install watertight vinyl gutter system.

- D. Interior joints:
  - 1. Secure joint assembly in place with anchors spaced at maximum of 2'-0" o.c.
  - 2. Level floor joints to top of joint with flooring material or Architect approved grout.
- E. Exterior expansion systems: Mechanically fasten frames to each side of joint and attach interior and exterior seals.
- F. Roof joint covers: Attach to curbs and substrates at 2'-0" o.c. maximum.
- G. Remove excess and misplaced sealants as work progresses.
- H. Remove protective film or coverings from expansion joint covers upon completion of adjacent construction.

End of Section

## SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section Includes:
  - 1. Standard hollow metal doors and frames.

# 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required.
- E. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

#### 1.3 QUALITY ASSURANCE

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.

## PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Amweld Building Products, LLC.
  - 2. Ceco Door Products; an Assa Abloy Group company.
  - 3. Curries Company; an Assa Abloy Group company.
  - 4. Firedoor Corporation.
  - 5. Fleming Door Products Ltd.; an Assa Abloy Group company.
  - 6. Kewanee Corporation (The).
  - 7. Mesker Door Inc.
  - 8. Pioneer Industries, Inc.
  - 9. Steelcraft; an Ingersoll-Rand company.
  - 10. Windsor Republic Doors.

## 2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS, Type B; suitable for exposed applications.

- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS, Type B.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF120) metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.
  - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- G. Mineral-Fiber Insulation: ASTM C 665, Type I.
- H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat.
- I. Glazing: Division 08 Section "Glazing."

### 2.3 STANDARD HOLLOW METAL DOORS

- A. General: Comply with ANSI/SDI A250.8.
  - 1. Design: Flush panel.
  - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
    - a. Thermal-Rated (Insulated) Doors: R-value of not less than 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W) when tested according to ASTM C 1363.
  - 3. Vertical Edges for Single-Acting Doors: Beveled edge, 1/8 inch in 2 inches (3 mm in 50 mm) or Manufacturer's standard.
  - 4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
  - 5. Tolerances: SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Comply with ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
  - 1. Level 3 and Physical Performance Level A (16 gage Extra Heavy Duty), Model 1 (Full Flush),.
- C. Hardware Reinforcement: ANSI/SDI A250.6.

# 2.4 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
  - 1. Fabricate frames with mitered or coped corners.
  - 2. Fabricate frames as face welded unless otherwise indicated.
  - 3. Frames for Level 3 Steel Doors: 16 gage, 0.053-inch- (1.3-mm-) thick steel sheet.

- C. Interior Frames: Fabricated from cold-rolled steel sheet.
  - 1. Fabricate frames with mitered or coped corners.
  - 2. Fabricate frames as face welded unless otherwise indicated.
  - 3. Frames for Wood Doors: 16 gage, 0.053-inch- (1.3-mm-) thick steel sheet.
  - 4. Frames for Borrowed Lights: 16 gage, 0.053-inch- (1.3-mm-) thick steel sheet.
- D. Hardware Reinforcement: ANSI/SDI A250.6.

### 2.5 FRAME ANCHORS

- A. Jamb Anchors:
  - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
  - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
  - 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
  - 4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
  - 5. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
  - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

## 2.6 STOPS AND MOLDINGS

- A. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.
- B. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, same material as frames.
- C. Terminated Stops: Where indicated, terminate stops 6 inches (152 mm) above finish floor with a 45degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

## 2.7 LOUVERS (Not Used)

## 2.8 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- (6.4-mm-thick by 25.4-mm-) wide steel.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

## 2.9 FABRICATION

- A. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- B. Hollow Metal Doors:
  - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors. Seal joints in top edges of doors against water penetration.
- C. Hollow Metal Frames: Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
  - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
  - 2. Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
  - 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  - 4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
  - 5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
  - 6. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
      - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
      - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
      - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
      - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
    - b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
      - 1) Three anchors per jamb up to 60 inches (1524 mm) high.
      - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
      - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
      - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
      - 5) Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal-stud partitions.
    - c. Compression Type: Not less than two anchors in each jamb.
    - d. Post-installed Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
  - 7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers.
    - a. Single-Door Frames: Three door silencers.
    - b. Double-Door Frames: Two door silencers.
- D. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
  - 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
  - 2. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware.

- 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
- E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
  - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
  - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
  - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
  - 4. Provide loose stops and moldings on inside of hollow metal work.
  - 5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

### 2.10 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
  - 1. Shop Primer: ANSI/SDI A250.10.

### PART 3 - EXECUTION

### 3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Section 017419-Construction Waste Management and Disposal.

#### 3.2 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

A. Manage indoor air quality in accordance with provisions of Section 013100-Project Management and Coordination

## 3.3 INSTALLATION

- A. Hollow Metal Frames: Comply with ANSI/SDI A250.11.
  - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    - a. At fire-protection-rated openings, install frames according to NFPA 80.
    - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    - c. Install door silencers in frames before grouting.
    - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    - e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    - f. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

- 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
  - a. Floor anchors may be set with powder-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.
- 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
- 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
- 5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
- 6. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
- 7. In-Place Gypsum Board Partitions: Secure frames in place with post-installed expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
- 8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
- 9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
  - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
  - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
  - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- B. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
  - 1. Non-Fire-Rated Standard Steel Doors:
    - a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    - b. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
    - c. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
- C. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
  - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

## 3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- C. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

### SECTION 083613 - SECTIONAL DOORS

### PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section includes electrically operated sectional doors.
- B. Related Section:
  - 1. Division 05 Section "Metal Fabrications" for miscellaneous steel supports.

### 1.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Sectional doors shall meet performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.
- B. Delegated Design: Design sectional doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Structural Performance: Exterior sectional doors shall withstand the effects of gravity loads, and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Wind Loads: As indicated on Drawings.
- D. Air Infiltration: Maximum rate not more than indicated when tested according to ASTM E 283 or DASMA 105.
  - 1. Air Infiltration: Maximum rate of 0.08 cfm/sq. ft. at 15 and 25 mph.
- E. Windborne-Debris-Impact-Resistance Performance: Provide glazed sectional doors that pass largemissile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and ASTM E 1996, DASMA 115.
- F. Seismic Performance: Sectional doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

### 1.3 SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Delegated-Design Submittal: For sectional doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Maintenance data.

F. Warranties: Sample of special warranties.

## 1.4 QUALITY ASSURANCE

- A. Wood Door Manufacturer Qualifications: (Not used)
- B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- C. Forest Certification: (Not used)
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Standard for Sectional Doors: Fabricate sectional doors to comply with DASMA 102 unless otherwise indicated.

## 1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 STEEL DOOR SECTIONS

- A. Exterior Section Faces and Frames: Fabricate from manufacturer's standard zinc-coated (galvanized), cold-rolled, steel sheet.
  - 1. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-ingroove weathertight seal, with a reinforcing flange return.
  - 2. For insulated doors, provide sections with continuous thermal-break construction, separating the exterior and interior faces of door.
- B. Section Ends and Intermediate Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet welded to door section. Provide intermediate stiles formed from galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches apart.
- C. Reinforce bottom section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal.
- D. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites.
- E. Provide reinforcement for hardware attachment.

- F. Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard[CFC-free] insulation, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within steel sections that incorporate the following interior facing material, with no exposed insulation:
  - 1. Interior Facing Material: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet.
- 2.2 WOOD DOOR SECTIONS (Not used)
- 2.3 ALUMINUM DOOR SECTIONS (Not used)
- 2.4 TRANSLUCENT DOOR SECTIONS (Not used)

### 2.5 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances shown on Drawings. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track spaced 2 inches apart for door-drop safety device. Slope tracks at proper angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.
- B. Track Reinforcement and Supports: Galvanized-steel track reinforcement and support members. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.
- C. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.
- D. Windows: Manufacturer's standard window units of type and size indicated and in arrangement shown. Provide removable stops of same material as door-section frames.

## 2.6 HARDWARE

- A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
- B. Hinges: Heavy-duty, galvanized-steel hinges at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails.
- C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Provide 3-inch diameter roller tires for 3-inch wide track and 2-inch diameter roller tires for 2-inch wide track.
- D. Push/Pull Handles: For push-up or emergency-operated doors, provide galvanized-steel lifting handles on each side of door.

## 2.7 LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.

- B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
  - 1. Lock Cylinders: Provide cylinders standard with manufacturer and keyed to building keying system.
  - 2. Keys: Three for each cylinder.
- C. Chain Lock Keeper: Suitable for padlock.
- D. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

## 2.8 COUNTERBALANCE MECHANISM

- A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.
- B. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.
- C. Cables: Galvanized-steel lifting cables.
- D. Cable Safety Device: Include, on each side-edge of door, a device designed to automatically stop door if either lifting cable breaks.
- E. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
- F. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.
- 2.9 MANUAL DOOR OPERATORS (Not used)

## 2.10 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and "operation cycles" requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
  - 1. Comply with NFPA 70.
  - 2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door-Operator Type: Unit of type indicated, consisting of electric motor, gears, pulleys, belts, sprockets, chains, and controls needed to operate door and meet required usage classification.
- D. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 11 Section "Common Motor Requirements for Equipment" unless otherwise indicated.
  - 1. Electrical Characteristics:

- a. Phase: [Single phase] [Polyphase].
- b. Volts: [115] [208] [230] [460] V.
- c. Hertz: 60.
- 2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
- 3. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec. without exceeding nameplate ratings or service factor.
- 4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
- E. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
  - Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.[ Provide self-monitoring capability designed to interface with door-operator control circuit to detect damage to or disconnection of sensor device.]
- F. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
  - 1. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
  - 2. Exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
- G. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- H. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- I. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- J. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.
- K. Radio-Control System: Consisting of three-channel universal coaxial receiver to open, close, and stop door; two per operator.

### 2.11 DOOR ASSEMBLY

- A. Steel and Full-Vision Aluminum Sectional Door: Sectional door formed with hinged sections.
- B. Steel Doors: (Not used)
- C. Aluminum Doors: (Not used)
- D. Available Manufacturers:

- a. Amarr Garage Doors.
- b. Arm-R-Lite.
- c. C.H.I. Overhead Doors.
- d. Clopay Building Products; a Griffon company.
- e. Fimbel Architectural Door Specialties.
- f. General American Door Company.
- g. Haas Door; a Nofziger company.
- h. Martin Door Manufacturing.
- i. Raynor.
- j. Rite-Hite Corporation.
- k. Wayne-Dalton Corp.
- I. Windsor Republic Doors.
- E. Operation Cycles: Not less than [10,000] [20,000] [50,000] [100,000].
- F. R-Value: R-15 minimum.
- G. Steel Sections: Zinc-coated (galvanized) steel sheet, formed into sections 2 inches thick.
  - 1. Exterior-Face Surface: Flat.
  - 2. Interior Facing Material: Zinc-coated (galvanized) steel sheet.
- H. Wood Sections: (Not used)
- I. Aluminum Sections: (Not used)
- J. Translucent Sections: (Not used)
- K. Track Configuration: Standard-lift track.
- L. Weatherseals: Fitted to bottom and top and around entire perimeter of door. Provide combination bottom weatherseal and sensor edge.
- M. Steel Doors: (Not used)
- N. Aluminum Doors: (Not used)
- O. Locking Devices: Equip door with slide bolt for padlock and chain lock keeper.
- P. Manual Door Operator: (Not used)
- Q. Electric Door Operator:
  - 1. Usage Classification: Standard duty, up to 60 cycles per hour.
  - 2. Operator Type: Jackshaft, side mounted.
  - 3. Motor Exposure: Interior, clean, and dry.
  - 4. Emergency Manual Operation: Chain type.
  - 5. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar .
  - 6. Remote-Control Station: Interior.
- R. Door Finish:
  - 1. Aluminum Finish: Clear anodized.
  - 2. Baked-Enamel or Powder-Coated Finish: Color and gloss as selected by Architect from manufacturer's full range.
  - 3. Factory Prime Finish: Manufacturer's standard color.
  - 4. Finish of Interior Facing Material: Finish as selected by Architect from manufacturer's full range.

### PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Tracks: Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment. Repair galvanized coating on tracks according to ASTM A 780.
- C. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion. Adjust doors and seals to provide weathertight fit around entire perimeter.

### 3.2 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

# **SECTION 086250**

# TUBULAR DAYLIGHTING DEVICE

# PART 1 GENERAL

- 1.1 SECTION INCLUDES
  - A. Tubular daylighting device, consisting of roof dome, reflective tube, and diffuser assembly; configuration as indicated on the drawings.
  - B. Accessories.

# 1.2 RELATED SECTIONS

- A. Section 07311 Asphalt Shingles: Flashing of skylight base.
- B. Section 07320 Roof Tiles: Flashing of skylight base.
- C. Section 07510 Built-Up Bituminous Roofing: Flashing of skylight base.
- D. Section 07530 Electrometric Membrane Roofing: Flashing of skylight base.
- E. Section 07550 Modified Bituminous Membrane Roofing: Flashing of skylight base.
- F. Section 07600 Flashing: Metal flashings.
- G. Section 08620 Unit Skylights: Skylights without reflective tube.
- H. Section 08630 Metal Framed Skylights.
- I. Section 15810 Ducts: Fan vent duct and connections.
- J. Section 16150 Equipment Wiring: Electrical connections.
- K. Section 16500 Lighting Equipment and Controls: Light bulbs and lamps.

# 1.3 REFERENCES

- A. ASTM B 209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- B. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2008a.
- C. ASTM A 463/A 463M Standard Specification for Steel Sheet, Aluminum Coated, by the Hot Dip Process; 2006.
- D. ASTM A 653/A 653M Standard Specification for Steel Sheet, Zinc Coated (Galvanized), by the Hot Dip Process; 2007.
- E. ASTM E 283 Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004.
- F. ASTM E 308 Standard Practice for Computing the Colors of Objects by Using the CIE System; 2006.

- G. ASTM E 330 Structural Performance of Exterior Windows, Curtain Walls and Doors; 2002.
- H. ASTM E 547 Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain walls by Cyclic Air Pressure Difference; 2000.
- I. ASTM E 1886 Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
- J. ASTM E 1996 Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricane.
- K. ASTM D 635 Test Method for Rate of Burning and/or Extent of Time of Burning of Self-Supporting Plastics in a Horizontal Position; 2006.
- L. ASTM D-1929 Test Method for Ignition Properties of Plastics; 1996 (2001).
- M. UL 181 Factory Made Air Ducts and Air Connectors
- N. ICC AC-16 Acceptance Criteria for Plastic Skylights; 2008.
- O. Florida Building Code TAS 201 Impact Test Procedures.
- P. Florida Building Code TAS 202 Criteria for Testing Impact and Non Impact Resistant Building Envelope Components Using Uniform Static Air Pressure Loading.
- Q. Florida Building Code TAS 203 Criteria for Testing Products Subject to Cyclic Wind Pressure Loading
- 1.4 PERFORMANCE REQUIREMENTS
  - A. Completed tubular daylighting device assemblies shall be capable of meeting the following performance requirements:
    - 1. Air Infiltration Test: Air infiltration will not exceed 0.30 cfm/sf aperture with a pressure delta of 1.57 psf across the tube when tested in accordance with ASTM E 283.
    - 2. Water Resistance Test: No uncontrolled water leakage at 10.5 psf pressure differential with water rate of 5 gallons/hour/sf when tested in accordance with ASTM E 547.
    - 3. Uniform Load Test:
      - a. No breakage, permanent damage to fasteners, hardware parts, or damage to make daylighting system inoperable or cause excessive permanent deflection of any section when tested at a Positive Load of 150 psf (7.18 kPa) or Negative Load of 70 psf (3.35 kPa).
      - b. All units shall be tested with a safety factor of (3) for positive pressure and (2) for negative pressure, acting normal to plane of roof in accordance with ASTM E 330.
    - 4. Hurricane Resistance:
      - a. Meets Florida Building Code TAS, 201, TAS, 202 and TAS 203 for Impact and non impact components.
      - b. Meets ASTM E 1886 and ASTM E1996 for missile and cyclic pressure differential testing.
    - 5. Fire Testing:
      - a. When used with the Dome Edge Protection Band, all domes meet fire

rating requirements as described in the 2006 International Building Code.

- b. Self-Ignition Temperature Greater than 650 degrees F per ASTM D-1929.
- c. Smoke Density Rating no greater than 450 per ASTM Standard E 84 in way intended for use. Classification C.
- d. Rate of Burn and/or Extent Maximum Burning Rate: 2.5 inches/min (62 mm/min) Classification CC-2 per ASTM D 635.
- e. Rate of Burn and/or Extent Maximum Burn Extent: 1 inch (25 mm) Classification CC-1 per ASTM D 635.
- 1.5 SUBMITTALS
  - A. Submit under provisions of Section 01300.
  - B. Product Data: Manufacturer's data sheets on each product to be used, including:
     1. Preparation instructions and recommendations.
    - 2. Storage and handling requirements and recommendations.
    - 3. Installation methods.
  - C. Shop Drawings. Submit shop drawings showing layout, profiles and product components, including anchorage, flashings and accessories.
  - D. Test Reports: Independent testing agency or evaluation service reports verifying compliance with specified performance requirements.

# 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engaged in manufacture of tubular daylighting devices for minimum 15 years.
- 1.7 DELIVERY, STORAGE, AND HANDLING
  - A. Store products in manufacturer's unopened packaging until ready for installation.
  - B. Store and dispose of solvent-based materials, and materials used with solventbased materials, in accordance with requirements of local authorities having jurisdiction.

# 1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- 1.9 WARRANTY
  - A. Daylighting Device: Manufacturer's standard warranty for 10 years.
  - B. Electrical Parts: Manufacturer's standard warranty for 5 years, unless otherwise indicated.

### PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Solatube International, Inc., which is located at: 2210 Oak Ridge Way; Vista, CA 92081; Toll Free Tel: 888-765-2882; Tel: 760-477-1120; Email: request info (commsales@solatube.com); Web: www.solatube.com
- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01600.
- D. General Contractor will bear responsibility for costs associated with substitution review.
- E. Requests for substitutions will be considered provided a lighting layout with photometric data is supplied to demonstrate light levels will meet original design intent.

# 2.2 DAYLIGHTING DEVICES

- A. Tubular Daylighting Devices General : Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICC AC-16.
- B. SolaMaster Series: Solatube Model 750 DS-O Open Ceiling, 21 inch (530 mm) Daylighting System:
  - 1. Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
    - a. Outer Dome Glazing: Type DA, 0.125 inch (3.2 mm) minimum thickness injection molded acrylic classified as CC2 material; UV inhibiting (100 percent UV C, 100 percent UV B and 98.5 percent UV C), impact modified acrylic blend.
    - b. Raybender 3000: Variable prism optic molded into outer dome to capture low angle sunlight and limit high angle sunlight.
    - c. Inner Dome Glazing: Type DAI, 0.115 inch (3 mm) minimum thickness acrylic classified as CC2 material.
    - d. Inner Dome Glazing: Type DPI, 0.115 inch (3 mm) minimum thickness polycarbonate classified as CC1 material.
  - 2. Roof Flashing Base:
    - a. One Piece: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube. Sheet steel, corrosion resistant conforming to ASTM A 653/A 653M or ASTM A 463/A 463M, 0.028 inch (0.7 mm) thick.
      - 1) Base Style: Type F4, Self mounted, 4 inches (102 mm) high.
      - 2) Base Style: Type F8, Self mounted, 8 inches (203 mm) high.
      - 3) Base Style: Type F11, Self mounted, 11 inches (279 mm) high.
      - 4) Base Style: Type FC, Curb cap, with inside dimensions of 27 inches by 27 inches (685 mm x 685 mm) to cover curb as specified in Section 07600.
    - Two Piece: Two-piece, inverted flange Metal Roof Flashing for Standing Seam Rib roof profile with greater than 14-3/8 inch (365 mm) minimum distance between ribs permitting a required greater than 2 inch (51 mm) clearance between flashing and rib: Type FSM. Aluminum 1060 Alloy, corrosion resistant conforming to ASTM B 209, 0.059 inch (1.5 mm) thick.
  - 3. Flashing Insulator: Type FI, Thermal isolation material for use under flashing.
  - 4. Dome Edge Protection Band: Type PB, For fire rated roofs with turret height less than 8 inches (203 mm). Galvanized steel. Nominal thickness of 0.039 inch (1 mm).

- 5. Roof Flashing Turret Extensions: Provide manufacturer's standard extensions for applications as requiring:
  - a. Type T12: Additional lengths of 12 inches (300 mm) extension.
  - b. Type T24: Additional lengths of 24 inches (600 mm) extension.
  - c. Type T36: Additional lengths of 36 inches (900 mm) extension.
  - d. Type T48: Additional lengths of 48 inches (1200 mm) extension.
- Tube Ring: Attached to top of base section; 0.090 inch (2.3 mm) nominal thickness injection molded high impact PVC; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing.
- 7. Tube Ring Seal: Attached to the base of the dome ring; butyl glazing rope 0.24 inch (6 mm) diameter; to minimize air infiltration
- 8. Dome Seal: Adhesive backed weatherstrip, 0.63 inch (16 mm) tall by 0.28 inch (7 mm) wide.
- 9. Reflective Tubes: Aluminum sheet, thickness 0.018 inch (0.5 mm).
  - a. General:
    - Interior Finish: Spectralight Infinity high reflectance specular finish on exposed reflective surface. Specular reflectance for visible spectrum (400 nm to 760 nm) greater than 99 percent. Total solar spectrum reflectance (400 nm to 2500 nm) less than 80.2 percent.
    - Color: a\* and b\* (defined by CIE L\*a\*b\* color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance to ASTM E 308.
  - b. Top Tube Angle Adapter, Type TA:
    - 1) Reflective 45 degree adjustable Top Tube Angle Adapter, 16 inches (406 mm) long.
  - c. Bottom Tube Angle Adapter, Type BA:
    - 1) Reflective 45 degree adjustable Bottom Tube Angle Adapter, 16 inches (406 mm) long
  - d. Top Tube Angle Adapter and Bottom Top Tube Angle Adapter Kit, Type AK:
    - 1) Reflective 45 degree adjustable top and bottom angle adapters (one each), 16 inches (406 mm) long
  - e. Extension Tube:
    - 1) Reflective extension tube, Type EXX, Notched for Open Ceiling diffuser attachment, 24 inches (610 mm) long
  - f. Reflective 90 degree Adjustable tube:
    - 1) Extension Tube Angle Adapter: Provide manufacturer's standard adapters for applications requiring:
      - a) Type A1 one 0 to 90 degree extension tube angle adapter.
      - b) Type A2 two 0 to 90 degree extension tube angle adapters.
- Diffuser Assemblies for Tubes Not Penetrating Ceilings (Open Ceiling): Solatube Model 750 DS-O. 21 inch (530 mm) diameter diffuser attached directly to bottom of tube.
  - a. Lens: Type L1 OptiView Fresnel lens design to maximize light output and diffusion. Visible Light Transmission shall be greater than 90 percent at 0.022 inch (0.6 mm) thick. Classified as CC2.
  - b. Lens: Type L2, Prismatic lens designed to maximize light output and diffusion. Visible Light Transmission shall be greater than 90 percent at 0.100 inch (2.5 mm) thick. Classified as CC2.
  - c. Diffuser Seal: Open cell foam, acrylic adhesive backed, 0.75 in (19 mm) wide by 0.125 in (3.2 mm) thick to minimize condensation and bug, dirt and air infiltration per ASTM E 283.
  - d. Diffuser Trim Ring: Injection molded acrylic. Nominal wall thickness

- 0.172 inches (4.4 mm)
- 11. Accessories:
  - a. Security Bar: Type B Security Bar 0.375 inch (95 mm) stainless steel bar across flashing diameter opening.
  - b. Open Ceiling Trim Ring: Type R, ABS Plastic, White; nominal thickness of 0.04 inch (1mm).
  - c. Wire Suspension Kit: Type E, Use the wire suspension kit when additional bracing to the structure is required.
  - d. Local Dimmer Control utilizing a butterfly baffle design of Spectralight Infinity reflective material to minimize shadowing when in use: Provided with dimmer switch and cable.
    - Daylight Dimmer: Type D Electro-mechanically actuated daylight valve; for universal input voltages ranging between 90 and 277 V at 50 or 60 Hz; maximum current draw of 50 ma per unit; controlled by low voltage, series Type T02: circuited, 4 conductor, size 22 cable; providing daylight output between 2 and 100 percent. Provided with dimmer switch and cable.
    - Switch: Type SW, Manufacturer-specific low voltage DC DP/DT switch (white) required to operate Daylight Dimmer. Note: only one switch is required per set of synchronously controlled dimmers.
    - 3) Cable: Type CA, Two conductor low voltage cable (500 foot) for multiple unit DC connection.
  - e. Security Kit: Type SK Dome Security Kit, rivets with nylon spacers to replace dome screws.

# 2.3 ACCESSORIES

- A. Fasteners: Same material as metals being fastened, non-magnetic steel, noncorrosive metal of type recommended by manufacturer, or injection molded nylon.
- B. Suspension Wire: Steel, annealed, galvanized finish, size and type for application and ceiling system requirement.
- C. Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

# PART 3 EXECUTION

# 3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

# 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

# 3.3 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions.
- B. After installation of first unit, field test to determine adequacy of installation. Conduct

water test in presence of Owner, Architect, or Contractor, or their designated representative. Correct if needed before proceeding with installation of subsequent units.

# 3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

# SECTION 08710

# DOOR HARDWARE

# PART 1 - GENERAL

# 1.1 SUMMARY:

- A. Section Includes: Finish Hardware for door openings, except as otherwise specified herein.
  - 1. Door hardware for steel (hollow metal) doors.
  - 2. Door hardware for aluminum doors.
  - 3. Door hardware for wood doors.
  - 4. Door hardware for other doors indicated.
  - 5. Keyed cylinders as indicated.
- B. Intent of Hardware Groups
  - 1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
  - 2. Where items of hardware aren't definitely or correctly specified, are required for completion of the Work, a written statement of such omission, error, or other discrepancy to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.
- C. Allowances
  - 1. Refer to Division 1 for allowance amount and procedures.
- D. Alternates
  - 1. Refer to Division 1 for Alternates and procedures.

# 1.2 SUBSTITUTIONS:

- A. Comply with Division 1
- 1.3 SUBMITTALS:
  - A. Comply with Division 1
  - B. Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure the "design intent" of the system/assembly is understood and can be reviewed together.
  - C. Product Data: Manufacturer's specifications and technical data including the following:
    - 1. Detailed specification of construction and fabrication.
    - 2. Manufacturer's installation instructions.
    - 3. Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
    - 4. Submit 6 copies of catalog cuts with hardware schedule.

- D. Shop Drawings Hardware Schedule: Submit 6 complete reproducible copy of detailed hardware schedule in a vertical format.
  - 1. List groups and suffixes in proper sequence.
  - 2. Completely describe door and list architectural door number.
  - 3. Manufacturer, product name, and catalog number.
  - 4. Function, type, and style.
  - 5. Size and finish of each item.
  - 6. Mounting heights.
  - 7. Explanation of abbreviations and symbols used within schedule.
  - 8. Detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.
- E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.
  - 1. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.
- F. Samples: (If requested by the Architect)
  - 1. 1 sample of Lever and Rose/Escutcheon design, (pair).
  - 2. 3 samples of metal finishes
- G. Contract Closeout Submittals: Comply with Division 1 including specific requirements indicated.
  - 1. Operating and maintenance manuals: Submit 3 sets containing the following.
    - a. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
    - b. Catalog pages for each product.
    - c. Name, address, and phone number of local representative for each manufacturer.
    - d. Parts list for each product.
  - 2. Copy of final hardware schedule, edited to reflect, "As installed".
  - 3. Copy of final keying schedule
  - 4. As installed "Wiring Diagrams" for each piece of hardware connected to power, both low voltage and 110 volts.
  - 5. One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

# 1.4 QUALITY ASSURANCE

- A. Comply with Division 1.
  - 1. Statement of qualification for distributor and installers.
  - 2. Statement of compliance with regulatory requirements and single source responsibility.
  - 3. Distributor's Qualifications: Firm with 3 years experience in the distribution of commercial hardware.
    - a. Distributor to employ full time Architectural Hardware Consultants (AHC) for the purpose of scheduling and coordinating hardware and establishing keying schedule.

- b. Hardware Schedule shall be prepared and signed by an AHC.
- 4. Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.
- 5. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.
  - a. Provide UL listed hardware for labeled and 20 minute openings in conformance with requirements for class of opening scheduled.
  - b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.
- 6. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.
- B. Review Project for extent of finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, notify the Architect in writing and furnish hardware in compliance with the Specification unless otherwise directed in writing by the Architect.
- 1.5 DELIVERY, STORAGE, AND HANDLING
  - A. Packing and Shipping: Comply with Division 1.
    - 1. Deliver products in original unopened packaging with legible manufacturer's identification.
    - 2. Package hardware to prevent damage during transit and storage.
    - 3. Mark hardware to correspond with "reviewed hardware schedule".
    - 4. Deliver hardware to door and frame manufacturer upon request.
  - B. Storage and Protection: Comply with manufacturer's recommendations.
- 1.6 PROJECT CONDITIONS:
  - A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.
  - B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.
- 1.7 WARRANTY:
  - A. Refer to Conditions of the Contract
  - B. Manufacturer's Warranty:
    - 1. Closers: Ten years
    - 2. Exit Devices: Three Years
    - 3. Locksets & Cylinders: Three years
    - 4. All other Hardware: Two years.
- 1.8 OWNER'S INSTRUCTION:
  - A. Instruct Owner's personnel in operation and maintenance of hardware units.

# 1.9 MAINTENANCE:

- A. Extra Service Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals Section.
  - 1. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
  - 2. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
  - 3. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra service materials.
- B. Maintenance Service: Submit for Owner's consideration maintenance service agreement for electronic products installed.

## PART 2 - PRODUCTS

# 2.1 MANUFACTURERS:

A. The following manufacturers are approved subject to compliance with requirements of the Contract Documents. Approval of manufacturers other than those listed shall be in accordance with Division 1.

Item: Hinges Continuous Hinges Locksets & Cylinders Exit Devices Pulls Closers Stops Overhead Stops Gasketing Manufacturer: Stanley Stanley Best Precision Trimco Stanley Trimco ABH Pemko Approved: McKinney, Hager Select, Hager No Substitution Von Duprin 99, Sargent 80 Rockwood, Hager LCN 4041, Norton 7500 Rockwood, Hager Glynn Johnson National Guard, Hager

# 2.2 MATERIALS:

- A. Hinges:
  - 1. Template screw hole locations
  - 2. Minimum of 2 permanently lubricated non-detachable bearings
  - 3. Equip with easily seated, non-rising pins
  - 4. Sufficient size to allow 180-degree swing of door
  - 5. Furnish hinges with five knuckles and flush bearings
  - 6. Provide hinge type as listed in schedule.
  - 7. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
  - 8. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish
  - 9. UL10C listed for Fire
- B. Geared Continuous Hinges:
  - 1. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1
  - 2. Anti-spinning through fastener
  - 3. UL10C listed for 3 hour Fire rating

- 4. Non-handed
- 5. Lifetime warranty
- 6. Provide Fire Pins for 3-hour fire ratings
- 7. Sufficient size to permit door to swing 180 degrees
- C. Mortise Type Locks and Latches:
  - 1. Tested and approved by BHMA for ANSI A156.13, Series 1000, Operational Grade 1, Extra-Heavy Duty, Security Grade 2 and be UL10C
  - 2. Fit ANSI A115.1 door preparation
  - 3. Functions and design as indicated in the hardware groups
  - 4. Solid, one-piece, 3/4-inch (19mm) throw, anti-friction latchbolt made of self-lubricating stainless steel
  - 5. Deadbolt functions shall have 1 inch (25mm) throw bolt made of hardened stainless steel
  - 6. Latchbolt and Deadbolt are to extend into the case a minimum of 3/8 inch (9.5mm) when fully extended
  - 7. Auxiliary deadlatch to be made of one piece stainless steel, permanently lubricated
  - 8. Provide sufficient curved strike lip to protect door trim
  - 9. Lever handles must be of forged or cast brass, bronze or stainless steel construction and conform to ANSI A117.1. Levers that contain a hollow cavity are not acceptable
  - 10. Lock shall have self-aligning, thru-bolted trim
  - 11. Levers to operate a roller bearing spindle hub mechanism
  - 12. Mortise cylinders of lock shall have a concealed internal setscrew for securing the cylinder to the lockset. The internal setscrew will be accessible only by removing the core, with the control key, from the cylinder body.
  - 13. Spindle to be designed to prevent forced entry from attacking of lever
  - 14. Provide locksets with 7-pin removable and interchangeable core cylinders
  - 15. Each lever to have independent spring mechanism controlling it
  - 16. Core face must be the same finish as the lockset
- D. Cylindrical Type Locks and Latchsets:
  - 1. Tested and approved by BHMA for ANSI A156.2, Series 4000, Operational Grade 1, Extra-Heavy Duty, and be UL10C listed
  - 2. Fit modified ANSI A115.2 door preparation
  - 3. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty
  - 4. Locksets to have anti-rotational studs that are thru-bolted
  - 5. Keyed lever shall not have exposed "keeper" hole
  - 6. Each lever to have independent spring mechanism controlling it
  - 7. 2-3/4 inch (70 mm) backset
  - 8. 9/16 inch (14 mm) throw latchbolt
  - 9. Outside lever sleeve to be seamless, of one-piece construction made of a hardened steel alloy
  - 10. Keyed lever to be removable only after core is removed, by authorized control key
  - 11. Provide locksets with 7-pin removable and interchangeable core cylinders
  - 12. Hub, side plate, shrouded rose locking pin to be a one-piece casting with a shrouded locking lug.
  - 13. Locksets outside locked lever must withstand a minimum 1400 inch pounds of torque. In excess of that, a replaceable part will shear. Key from outside and inside lever will still operate lockset
  - 14. Core face must be the same finish as the lockset
  - 15. Functions and design as indicated in the hardware groups
- E. Exit Devices shall:

- 1. Tested and approved by BHMA for ANSI 156.3, Grade 1
- 2. Provide a deadlocking latchbolt
- 3. Non-fire rated exit devices shall have cylinder dogging.
- 4. Touchpad shall be "T" style
- 5. Exposed components shall be of architectural metals and finishes.
- 6. Lever design shall match lockset lever design
- 7. Provide strikes as required by application.
- 8. Fire exit devices to be listed for UL10C
- 9. UL listed for Accident Hazard
- 10. Provide vandal resistant or breakaway trim
- 11. Aluminum vertical rod assemblies are acceptable only when provide with the manufacturers optional top and bottom stainless steel rod guard protectors
- F. Cylinders:
  - 1. Provide the necessary cylinder housings, collars, rings & springs as recommended by the manufacturer for proper installation.
  - 2. Provide the proper cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets.
  - 3. Coordinate and provide as required for related sections.
- G. Door Closers shall:
  - 1. Tested and approved by BHMA for ANSI 156.4, Grade 1
  - 2. UL10C certified
  - 3. Closer shall have extra-duty arms and knuckles
  - 4. Conform to ANSI 117.1
  - 5. Maximum 2 7/16 inch case projection with non-ferrous cover
  - 6. Separate adjusting valves for closing and latching speed, and backcheck
  - 7. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
  - 8. Full rack and pinion type closer with 1<sup>1</sup>/<sub>2</sub>" minimum bore
  - 9. Mount closers on non-public side of door, unless otherwise noted in specification
  - 10. Closers shall be non-handed, non-sized and multi-sized 1 through 6
- H. Kickplates: Provide with four beveled edges, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.
- I. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.
- J. Key Control: Provide one wall mounted key cabinet complete with hooks, index and tags with Best cylinder and core. Hook quantity 50% over lock quantity.
- K. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.
- 2.3 FINISH:
  - A. Designations used in Schedule of Finish Hardware 3.5, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products
  - B. Powder coat door closers to match other hardware, unless otherwise noted.

C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

# 2.4 KEYS AND KEYING:

- A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.
- B. Cylinders, removable and interchangeable core system: Best Standard 7-pin.
- C. Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."
- D. Transmit Grand Masterkeys, Masterkeys and other Security keys to Owner by Registered Mail, return receipt requested.
- E. Furnish keys in the following quantities:
  - 1. 3 each Grand Masterkeys
  - 2. 6 each Masterkeys
  - 3. 2 each Control keys
  - 4. 3 each Change keys each keyed core
  - 5. 12 each Construction masterkeys
  - 6. 2 each Construction Control keys
- F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.
- G. Keying Schedule: Arrange for a keying meeting, and programming meeting with Architect Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements. Furnish 3 typed copies of keying and programming schedule to Architect.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.
  - 1. Do not proceed until unsatisfactory conditions have been corrected.

# 3.2 HARDWARE LOCATIONS:

- A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.
  - 1. Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).
  - 2. NWWDA Industry Standard I.S.1.7, Hardware Locations for Wood Flush Doors.

# 3.3 INSTALLATION:

- A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- B. Conform to local governing agency security ordinance.
- C. ADA Standard: Conform to ANSI A117.1 for positioning requirements for disabled.
- D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use "Riv-Nuts" or similar products.

# 3.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

- A. Contractor/Installers, Field Services: After installation is complete, contractor shall inspect completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.
  - 1. Check and adjust closers to ensure proper operation.
    - a. Adjust closer to complete full closing cycle in less than 4 to 6 seconds without abrupt change of speed between "Sweep" and "Latch" speeds.
    - b. Adjust "Backcheck" according to manufacturer's instructions.
    - c. Set exterior doors closers to have 8.5 lbs maximum pressure to open, interior nonrated at 5 lbs, rated openings at 12 lbs
  - 2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.
    - a. Verify levers are free from binding.
    - b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.
  - 3. Report findings, in writing, to architect and hardware supplier outlining corrective actions and recommendations.

### SECTION 092216 - NON-STRUCTURAL METAL FRAMING

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes non-load-bearing steel framing members for the following applications:
  - 1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
  - 2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

# 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

#### 1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-loadbearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. Sound Transmission Characteristics: For STC-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

### PART 2 - PRODUCTS

### 2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
  - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
  - 2. Protective Coating: Manufacturer's standard corrosion-resistant zinc coating, G60 or equivalent, unless otherwise indicated.

#### 2.2 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch diameter wire, or double strand of 0.0475-inch diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- C. Flat Hangers: Steel sheet, 1 by 3/16 inch.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch wide flanges.
  - 1. Depth: 1-1/2 inches.

- E. Furring Channels (Furring Members):
  - 1. Cold-Rolled Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch wide flanges, 3/4 inch deep.
  - 2. Metal Studs: ASTM C 645.
    - a. Minimum Base-Metal Thickness: 0.0179 inch.
    - b. Depth: 1-5/8 inches, 2-1/2 inches or 3-5/8 inches and as indicated on drawings.
  - 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
    - a. Minimum Base Metal Thickness: 0.0179 inch.
  - 4. Resilient Furring Channels: 1/2-inch deep members designed to reduce sound transmission.
    - a. Configuration: Asymmetrical.
- F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
    - b. Chicago Metallic Corporation; 640-C Drywall Furring System.
    - c. USG Corporation; Drywall Suspension System.

#### 2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.
  - 1. Minimum Base-Metal Thickness: 0.0179 inch.
- B. Slip-Type Head Joints: Where indicated, provide one of the following:
  - 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
  - 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
  - 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
    - a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - b. Products: Subject to compliance with requirements, provide one of the following:
      - 1) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
      - 2) Superior Metal Trim; Superior Flex Track System (SFT).
- C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  - 1. Minimum Base-Metal Thickness: 0.0179 inch.
- D. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch wide flanges.

- 1. Depth: 1-1/2 inches.
- 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch thick, galvanized steel.
- E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Minimum Base Metal Thickness: 0.0179 inch.
  - 2. Depth: 7/8 inch.
- F. Resilient Furring Channels: 1/2-inch deep, steel sheet members designed to reduce sound transmission.
  - 1. Configuration: Asymmetrical.
- G. Cold-Rolled Furring Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch wide flanges.
  - 1. Depth: 3/4 inch.
  - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch.
  - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch diameter wire, or double strand of 0.0475-inch diameter wire.

#### 2.4 AUXILIARY MATERIALS

- A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide the following:
  - 1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

#### PART 3 - EXECUTION

- 3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
  - A. Manage construction waste in accordance with provisions of Section 017419-Construction Waste Management and Disposal.

#### 3.2 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
  - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

### 3.3 INSTALLING SUSPENSION SYSTEMS

- A. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- B. Suspend hangers from building structure as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

- a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
- 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
  - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
- 3. Do not attach hangers to steel roof deck.
- 4. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
- 5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
- 6. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- C. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- D. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

#### 3.4 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
  - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two 20 gage studs at each jamb, unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  - 4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- C. Direct Furring:
  - 1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- D. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

### SECTION 092900 - GYPSUM BOARD

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Interior gypsum board.

# 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For the following products:
  - 1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.
- 1.3 QUALITY ASSURANCE (Not used)

#### PART 2 - PRODUCTS

#### 2.1 INTERIOR GYPSUM BOARD

- A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. American Gypsum Co.
    - b. BPB America Inc.
    - c. G-P Gypsum.
    - d. Lafarge North America Inc.
    - e. National Gypsum Company.
    - f. PABCO Gypsum.
    - g. Temple.
    - h. USG Corporation.
- B. Impact Resistant:
  - 1. Thickness: 5/8 inch (15.9 mm).
  - 2. Long Edges: Tapered.
- C. Type X: (Not used)
- D. Moisture- and Mold-Resistant Type: (Not used)

- 2.2 HIGH IMPACT PANELS FOR CEILINGS (Not used)
- 2.3 TILE BACKING PANELS (Not used)

### 2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
  - 1. Material: Paper-faced galvanized steel sheet.
  - 2. Shapes:
    - a. Cornerbead.
    - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - c. L-Bead: L-shaped; exposed long flange receives joint compound.
    - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    - e. Expansion (control) joint.
- B. Exterior Trim: ASTM C 1047.
  - 1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
  - 2. Shapes:
    - a. Cornerbead.
    - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

### 2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  - 1. Interior Gypsum Wallboard: Paper.
  - 2. Exterior Gypsum Soffit Board: Paper.
  - 3. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
  - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
  - 5. Skim Coat: For final coat of Level 5 finish where required to produce uniform finish primarily on walls that receive dark colors and/or subject to severe lighting, use setting-type, sandable topping compound for skim coat to be troweled on or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
- D. Joint Compound for Exterior Applications:
- E. Joint Compound for Tile Backing Panels:

- 1. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
- 2. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
- 3. Cementitious Backer Units: As recommended by backer unit manufacturer.

### 2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
  - 1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
- D. Sound Attenuation Blankets: 3 inch thickness, ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
  - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
  - Recycled Content: Provide blankets with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 10 percent (20 percent) by weight.
- E. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."
  - 1. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."
- G. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."
- 2.7 TEXTURE FINISHES (Not Used)

### PART 3 - EXECUTION

- 3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
  - A. Manage construction waste in accordance with provisions of Section 017419-Construction Waste Management and Disposal.
- 3.2 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT
  - A. Manage indoor air quality in accordance with provisions of Section 013100-Project Management and Coordination

### 3.3 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

#### 3.4 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
  - 1. Type X: As indicated on Drawings or if not indicated, where required for fire-resistance-rated assembly.
  - 2. Special Type X: Where required for specific fire-resistance-rated assembly indicated.
  - 3. Moisture- and Mold-Resistant Type: As indicated on Drawings.

# 3.5 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS (Not Used)

3.6 APPLYING TILE BACKING PANELS (Not used)

#### 3.7 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners, unless otherwise indicated.
  - 2. LC-Bead: Use at exposed panel edges.
  - 3. L-Bead: Use where indicated.
  - 4. U-Bead: Use at exposed panel edges.
- D. Exterior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners.
  - 2. LC-Bead: Use at exposed panel edges.

#### 3.8 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

- D. Gypsum Board Finish Levels: Finish panels to levels indicated below:
  - 1. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in other Division 09 Sections.
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- F. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.
- 3.9 APPLYING TEXTURE FINISHES (Not Used)

#### 3.10 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

### SECTION 096513 - RESILIENT BASE AND ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Resilient base.
  - 2. Resilient stair accessories. (Not Applicable)
  - 3. Resilient molding accessories. (Not Applicable)

### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

# 1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

#### 1.4 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.
- C. Install resilient products after other finishing operations, including painting, have been completed.

### PART 2 - PRODUCTS

#### 2.1 RESILIENT BASE

- A. Resilient Base:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allstate Rubber Corp.; Stoler Industries.
    - b. Armstrong World Industries, Inc.
    - c. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
    - d. Endura Rubber Flooring; Division of Burke Industries, Inc.
    - e. Johnsonite.
    - f. Mondo Rubber International, Inc.
    - g. Musson, R. C. Rubber Co.

- h. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
- i. Roppe Corporation, USA.
- B. Resilient Base Standard: ASTM F 1861.
  - 1. Material Requirement: Type TS (rubber, vulcanized thermoset).
  - 2. Manufacturing Method: Group I (solid, homogeneous).
  - 3. Style: Cove (base with toe).
- C. Minimum Thickness: 0.125 inch (3.2 mm).
- D. Height: 4 inches (102 mm).
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Preformed.
- G. Inside Corners: Job formed.
- H. Finish: As selected by Architect from manufacturer's full range.
- I. Colors and Patterns: As indicated on the drawings schedule.

#### 2.2 RESILIENT STAIR ACCESSORIES (Not Used)

- 2.3 RESILIENT MOLDING ACCESSORY (Not Used)
- 2.4 INSTALLATION MATERIALS (Not used)

#### PART 3 - EXECUTION

#### 3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Section 017419-Construction Waste Management and Disposal.

#### 3.2 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

A. Manage indoor air quality in accordance with provisions of Section 013100-Project Management and Coordination

#### 3.3 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

- C. Do not install resilient products until they are same temperature as the space where they are to be installed.
  - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

## 3.4 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- 3.5 RESILIENT ACCESSORY INSTALLATION (Not used)

### 3.6 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Cover resilient products until Substantial Completion.

### SECTION 099113 - EXTERIOR PAINTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:
  - 1. Steel Doors and Frames
  - 2. Galvanized metal.

## 1.2 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each finish and for each color and texture required.
- C. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

#### 1.4 QUALITY ASSURANCE

- A. MPI Standards:
  - 1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
  - 2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

### 1.5 EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
  - 1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

#### PART 2 - PRODUCTS

2.1 Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in Part 3.5 Exterior Painting Schedule for the paint category indicated.

### 2.2 PAINT, GENERAL

- A. Material Compatibility:
  - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. Colors: As selected by Architect from manufacturer's full range and As indicated in the Material Finish Schedule.

#### PART 3 - EXECUTION

#### 3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Section 017419-Construction Waste Management and Disposal.

#### 3.2 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

A. Manage indoor air quality in accordance with provisions of Section 013100-Project Management and Coordination

#### 3.3 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Concrete: 12 percent.
  - 2. Masonry (CMU): 12 percent.
  - 3. Gypsum Board: 12 percent.

- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
  - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

### 3.4 PREPARATION AND APPLICATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- D. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.
- 3.5 EXTERIOR PAINTING SCHEDULE
  - A. Steel, Doors & Frames Ferrous Metal:
    - 1. Acrylic System
      - a. Prime Coat: Pro-Cryl Universal Primer
      - b. Intermediate: Sher-Cryl HPA
      - c. Top Coat: Sher-Cryl HPA
  - B. Galvanized Metal:
    - 1. Acrylic System
      - a. Prime Coat: Pro-Cryl Universal Primer
      - b. Intermediate: Sher-Cryl HPA
      - c. Top Coat: Sher-Cryl HPA
      - a.

### SECTION 099123 - INTERIOR PAINTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following interior substrates:
  - 1. Concrete.
  - 2. Miscellaneous steel.
  - 3. Exposed steel beams and bar joist.
  - 4. Exposed metal decking.
  - 5. Gypsum board.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each finish and for each color and texture required.
- C. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

#### 1.3 QUALITY ASSURANCE

- A. MPI Standards:
  - 1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
  - 2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

### 1.4 EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
  - 1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

#### PART 2 - PRODUCTS

- 2.1 PAINTS AND COATINGS (EQc4.2)
  - A. Paints and Coatings in this Section must comply with Green Seal Standard GS-11, Green Seal Standard GC-03, and South Coast Air Quality Management District Rule 1113.

# 2.2 PAINT, GENERAL

- A. Material Compatibility:
  - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
  - 1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
  - 2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
  - 3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
  - 4. Floor Coatings: VOC not more than 100 g/L.
  - 5. Shellacs, Clear: VOC not more than 730 g/L.
  - 6. Shellacs, Pigmented: VOC not more than 550 g/L.
  - 7. Flat Topcoat Paints: VOC content of not more than 50 g/L.
  - 8. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
  - 9. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
  - 10. Floor Coatings: VOC not more than 100 g/L.
  - 11. Shellacs, Clear: VOC not more than 730 g/L.
  - 12. Shellacs, Pigmented: VOC not more than 550 g/L.
  - 13. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
  - 14. Dry-Fog Coatings: VOC content of not more than 400 g/L.
  - 15. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
  - 16. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.
- C. Chemical Components of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions; these requirements do not apply to primers or finishes that are applied in a fabrication or finishing shop:
  - 1. Flat Paints and Coatings: VOC content of not more than 50 g/L.
  - 2. Nonflat Paints and Coatings: VOC content of not more than 150 g/L.
  - 3. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
  - 4. Restricted Components: Paints and coatings shall not contain any of the following:
    - a. Acrolein.
    - b. Acrylonitrile.
    - c. Antimony.
    - d. Benzene.
    - e. Butyl benzyl phthalate.
    - f. Cadmium.
    - g. Di (2-ethylhexyl) phthalate.
    - h. Di-n-butyl phthalate.
    - i. Di-n-octyl phthalate.
    - j. 1,2-dichlorobenzene.
    - k. Diethyl phthalate.
    - I. Dimethyl phthalate.
    - m. Ethylbenzene.
    - n. Formaldehyde.
    - o. Hexavalent chromium.
    - p. Isophorone.
    - q. Lead.
    - r. Mercury.

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- s. Methyl ethyl ketone.
- t. Methyl isobutyl ketone.
- u. Methylene chloride.
- v. Naphthalene.
- w. Toluene (methylbenzene).
- x. 1,1,1-trichloroethane.
- y. Vinyl chloride.
- D. Colors: As indicated in a color schedule.

#### PART 3 - EXECUTION

## 3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Section 017419-Construction Waste Management and Disposal.

# 3.2 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

A. Manage indoor air quality in accordance with provisions of Section 013100-Project Management and Coordination

#### 3.3 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Concrete: 12 percent.
  - 2. Masonry (CMU): 12 percent.
  - 3. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
  - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

# 3.4 PREPARATION AND APPLICATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

- D. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
  - 1. Mechanical Work:
    - a. Uninsulated metal piping.
    - b. Uninsulated plastic piping.
    - c. Pipe hangers and supports.
    - d. Tanks that do not have factory-applied final finishes.
    - e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
    - f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    - g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
  - 2. Electrical Work:
    - a. Switchgear.
    - b. Panelboards.
    - c. Electrical equipment that is indicated to have a factory-primed finish for field painting.
- E. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- F. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

## 3.5 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces: (Not used)
- B. Concrete Substrates, Traffic Surfaces:
  - 1. Water-Based Clear Sealer System: MPI INT 3.2G.
    - a. First Coat: Interior/exterior clear concrete floor sealer (water based).
    - b. Topcoat: Interior/exterior clear concrete floor sealer (water based).
  - 2. Heavy Duty Floor Coatings: Two Component Polyamide Epoxy Coating.
    - a. Locations: Refer to Finish Plan Drawings for Epoxy Flooring Areas.
    - b. First Coat: Sherwin Williams Armorseal 1000 HS or approved equal.
    - C. Second Coat: Sherwin Williams Armorseal 1000 HS or approved equal.
- C. Clay-Masonry Substrates: (Not used)
- D. CMU Substrates: (Not used)
- E. Steel Substrates:
  - 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
    - a. Prime Coat: Quick-drying alkyd metal primer.
    - b. Intermediate Coat: Interior acrylic latex enamel matching topcoat.
    - c. Topcoat: Interior acrylic latex enamel (satin).
- F. Galvanized-Metal Substrates:

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- 1. Latex Over Waterborne Primer System: MPI INT 5.3J.
  - a. Prime Coat: Waterborne galvanized-metal primer.
  - b. Intermediate Coat: Interior acrylic latex matching topcoat.
  - c. Topcoat: Interior acrylic latex (satin).
- G. Aluminum (Not Anodized or Otherwise Coated) Substrates: (Not used)
- H. Glue-Laminated Beam and Column Substrates: (Not used)
- I. Dressed Lumber Substrates: (Not used)
- J. Wood Panel Substrates: (Not used)
- K. Dimension Lumber Substrates, Nontraffic Surfaces: (Not used)
- L. Wood Substrates, Traffic Surfaces: (Not used)
- M. Gypsum Board Substrates:
  - 1. Latex System: MPI INT 9.2A.
    - a. Prime Coat: Interior latex primer/sealer.
    - b. Intermediate Coat: Interior acrylic latex matching topcoat.
    - c. Topcoat: Interior acrylic latex (Satin)
- N. Plaster Substrates: (Not used)
- O. Spray-Textured Ceiling Substrates: (Not used)
- P. Cotton or Canvas Insulation-Covering Substrates: (Not used)

# SECTION 102600 - WALL AND DOOR PROTECTION

# PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Wall guards. (Not used)
  - 2. Corner guards.

# 1.2 PERFORMANCE REQUIREMENTS (Not used)

# 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each exposed product and for each color and texture specified, 12 inches (300 mm) long.
- C. Maintenance data.
- D. Warranty: Sample of special warranty.

## 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Surface-Burning Characteristics: As determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.
- C. Regulatory Requirements: Comply with applicable provisions in ICC/ANSI A117.1.

## 1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures.
    - b. Deterioration of plastic and other materials beyond normal use.
  - 2. Warranty Period: Five years from date of Substantial Completion.

# PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Vinyl/Acrylic: Extruded material should be high impact Acrovyn with pebblette grain texture, nominal .078" (1.98mm) thickness. Chemical and stain resistance should be per ASTM D-1308 standards as established by the manufacturer. Colors to be indicated in the finish schedule from one of manufacturer's standard color range.
- B. Aluminum Retainers: Extruded aluminum retainers should be 6063-T6 alloy, nominal .090" (2.29mm) thickness. Minimum strength and durability properties as specified in ASTM B221.
- C. Fasteners: All fasteners to be non-corrosive and compatible with aluminum retainers. All necessary fasteners to be supplied by the manufacturer.
- D. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer and with a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.2 CORNER GUARDS

- A. Surface-Mounted, Opaque-Plastic Corner Guards: Fabricated from PVC plastic, acrylic-modified vinyl sheet or opaque polycarbonate sheet; with formed edges; fabricated with 90- or 135-degree turn to match wall condition; located at all interior gypsum board corners.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Floor Products Co., Inc.
    - b. Arden Architectural Specialties, Inc.
    - c. Balco, Inc.
    - d. Boston Retail Products.
    - e. Construction Specialties, Inc.
    - f. IPC Door and Wall Protection Systems; Division of InPro Corporation.
    - g. Korogard Wall Protection Systems; a division of RJF International Corporation.
    - h. Kwalu, LLC.
    - i. Musson Rubber Company.
    - j. Pawling Corporation.
    - k. Tepromark International, Inc.
    - I. WallGuard.com.
    - m. wallProtex.
  - 2. Mounting: Countersunk screws through factory-drilled mounting holes.
  - 3. Color and Texture: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
  - 1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.

- 2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
  - a. Provide anchoring devices to withstand imposed loads.
  - b. Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches (305 mm).
  - c. Adjust end and top caps as required to ensure tight seams.
- B. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.
- C. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

# SECTION 104413 - FIRE EXTINGUISHER CABINETS

# PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section includes fire protection cabinets for fire extinguishers.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Maintenance data.

#### 1.3 QUALITY ASSURANCE

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire protection cabinets with wall depths.

## PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Stainless-Steel Sheet: ASTM A 666, Type 304.
- C. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

# 2.2 FIRE PROTECTION CABINET (FEC)

- A. Cabinet Type: Suitable for fire extinguisher.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. J. L. Industries, Inc., a division of Activar Construction Products Group.
    - b. Kidde Residential and Commercial Division, Subsidiary of Kidde plc.
    - c. Larsen's Manufacturing Company.
    - d. Watrous Division, American Specialties, Inc.
- B. Cabinet Construction: Nonrated.

- C. Cabinet Material: Steel sheet.
- D. Surface-mounted Cabinet: Coordinate cabinet trim material in first paragraph below with door construction. These materials are available for both nonrated and fire-rated cabinets. Delete if no trim.
- E. Door Material: Stainless-steel sheet.
- F. Door Style: Fully glazed panel with frame.
- G. Door Glazing: Tempered float glass (clear).
- H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
- I. Accessories:
  - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
  - 2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
  - 3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
    - a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
      - 1) Location: Applied to cabinet door.
      - 2) Application Process: Silk-screened.
      - 3) Lettering Color: Red.
      - 4) Orientation: Vertical.

#### J. Finishes:

- 1. Manufacturer's standard baked-enamel paint for the following:
  - a. Interior of cabinet.
- 2. Stainless Steel: No. 6.

## 2.3 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Miter and weld joints and grind smooth.

## PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed and prepare recesses as required by type and size of cabinet and trim style.
- B. Install fire protection cabinets in locations and at mounting heights acceptable to authorities having jurisdiction.
- C. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

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- D. Identification: Apply decals at locations indicated.
- E. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- F. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

# SECTION 104416 - FIRE EXTINGUISHERS

# PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.
- C. Warranty: Sample of special warranty.

#### 1.3 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
- C. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

## 1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Failure of hydrostatic test according to NFPA 10.
    - b. Faulty operation of valves or release levers.
  - 2. Warranty Period: Six years from date of Substantial Completion.

## PART 2 - PRODUCTS

# 2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Badger Fire Protection; a Kidde company.
    - b. J. L. Industries, Inc.; a division of Activar Construction Products Group.

# DTO - COMMAND VEHICLE STORAGE

- c. Larsen's Manufacturing Company.
- 2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type: UL-rated, 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.
- C. HFC blend agent and inert material in enameled-steel container; with pressure-indicating gage.

# 2.2 MOUNTING BRACKETS (FE)

- A. Mounting Brackets (Mechanical Room): Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Badger Fire Protection; a Kidde company.
    - b. J. L. Industries, Inc.; a division of Activar Construction Products Group.
    - c. Larsen's Manufacturing Company.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
  - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
    - a. Orientation: Vertical.

## PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Examine fire extinguishers for proper charging and tagging.
  - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
  - 1. Mounting Brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 – GENERAL

# 1.1 REFER TO RELATED SECTIONS

A. Section 23 05 01 – Mechanical and Electrical Coordination Section 23 05 02 – Basic Mechanical Requirements Section 23 05 03 – Basic Mechanical Material and Methods Section 23 05 13 – Motors and Starters Section 23 05 21 – Pipe and Pipe Fittings Section 23 05 22 – Piping Accessories Section 23 05 23 – Valves Section 23 05 29 – Pipe Support and Anchors Section 23 05 30 – Electronic Speed Controllers Section 23 05 48 – Vibration Control Section 23 05 49 – Seismic Restraints Section 23 05 53 – Mechanical Identification

PART 2 – NOT USED

PART 3 - NOT USED

# SECTION 220700 - PLUMBING INSULATION

PART 1 – GENERAL

- 1.1 REFER TO RELATED SECTIONS
  - A. Section 23 07 00 Mechanical Insulation

PART 2 – NOT USED

PART 3 - NOT USED

SECTION 22 10 00 - PLUMBING PIPING

PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplemental Conditions of the Construction Contract, and Division 1 Specification Sections (General Requirements), apply to this Section.

#### 1.2 SUBMITTALS

- A. Submit manufacturer's data on the following:
  - 1. Pressure reducing valves.
  - 2. Backflow preventers.
  - 3. Water hammer arresters.
  - 4. Roof drains, floor drains, floor sinks, cleanouts and area drains.
  - 5. Downspout nozzles.
  - 6. Manhole frames and covers.
  - 7. Trap primers
  - 8. Trap guards

#### 1.3 STANDARDS

- A. Materials shall comply with the following standards.
  - 1. Cast iron pipe:
    - a. ASTM A-74-87
    - b. CISPI 301 (must bear trademark label on pipe)
  - 2. Cast iron pipe fittings:
    - a. ASTM A-888
    - b. CISPI
  - 3. Cast iron pipe couplings ASTM C-564
  - 4. Copper pipe:
    - a. Type K, L, M: ASTM B88
    - b. DWV: ASTM B306-88
  - 5. Ductile iron pipe: ASTM A377-89

## 1.4 RELATED WORK

A. Section 230529 Pipe Supports and Anchors.

# PART 2 – PRODUCTS

#### 2.1 DOMESTIC WATER PIPING AND ACCESSORIES

- A. Above Ground Inside Building, Size 4" and Under:
  - 1. Pipe: Copper tube, hard temper, Type L.
  - 2. Fittings: Wrought copper, or cast bronze.
  - 3. Solder: 95-5 tin antimony (no lead).
  - 4. Refer to section 220521 for other acceptable joining methods for copper tube 4" and smaller.
- B. Below Ground Inside Building, Size 2" and Under:
  - 1. Pipe: Copper tube, annealed, Type K.
  - 2. Fittings: Wrought copper, brazed.
- C. Below Ground Outside Building, 2 ½ " and Over:
  - 1. Ductile pressure pipe, tar coated, cement lined:
    - a. Pipe: ANSI A21.51, Class 50.
    - b. Fittings: ANSI 21.10.
    - c. Rubber Gaskets: ANSI 21.11.
- D. Use approved fittings for connections between dissimilar pipe systems.

# 2.2 BACKFLOW PREVENTER, REDUCED PRESSURE ZONE TYPE

- A. Manufacturer:
  - 1. Design Basis: Watts No.SS009QT Series
  - Construction: Stainless steel trim and body, complete with test cocks, resilient seat, shutoff valves, and air gap fitting.
  - 3. Other Acceptable Manufacturers:
    - a. Beeco
    - b. Febco
    - c. Wilkins
  - 4. Complies with ASSE STD 1013

#### 2.3 BACKFLOW PREVENTER, (REDUCED PRESSURE ZONE TYPE) (DOMESTIC WATER SERVICE)

- A. Manufacturer:
  - 1. Design Basis: Watts No. 909, (1/2" through 10")
  - 2. Construction: Bronze body, stainless steel trim, complete with test cocks, resilient seat,
  - shut-off valves, and air gap fitting.
  - 3. Other Acceptable Manufacturers:
    - a. Beeco
    - b. Febco
    - c. Wilkins
  - 4. Complies with ASSE STD 1013.

# 2.4 BACKFLOW PREVENTER (ATMOSPHERIC VACUUM BREAKER)

# A. Manufacturer:

- 1. Design Basis: Watts No. 008 Series (3/8" through 1")
- 2. Construction: Bronze body, ball valve shut offs.
- 3. Other Acceptable Manufacturers:
  - a. Beeco
  - b. Febco
  - c. Wilkins
- 4. Complies with ASSE STD 1020.

#### 2.5 WATER HAMMER ARRESTER (SHOCK ABSORBERS)

- A. Manufacturers:
  - 1. Design Basis: Zurn Shoktrol Z-1700
  - 2. Construction: Stainless Steel, Bellows
  - 3. Other Acceptable Manufacturers:
    - a. Josam
    - b. Sioux Chief
    - c. J.R. Smith
  - 4. Standards: PDI WH201, ASSE STD 1010.

#### 2.6 TRAP PRIMERS (TP)

- A. Manufacturers:
  - 1. Design basis: PPP as noted in Plumbing Fixture Schedule.
  - 2. Construction: Corrosion resistant brass. "O" rings shall have a flexibility range of -40°F to 450°F.
  - 3. Provide distribution units for connector points as shown on plans.
  - 4. Complies with ASSE STD 1018.
- 2.7 TRAP GUARDS (TG)
  - A. Manufacturers:
    - 1. Design basis: ProSet Trap Guard
    - 2. Construction: A flexible tube made of elastmeric material that is treated to roll up when water is passing through drain.
    - 3. Install in floor drains and floor sinks from 2" up to and including 4" as shown on plans indicated with a (TG) behind drain designation.
    - 4. Larger sizes can be custom made by ProSet upon request.
    - 5. Use of trap guards as approved by local authority.

#### 2.8 SANITARY AND VENT PIPING (WITHIN BUILDING)

- A. Above Ground:
  - 1. Cast iron hub and spigot, neoprene gasket.
  - 2. Cast iron no hub, neoprene gasket and stainless steel sleeve joint.

- 3. DWV copper with DWV fittings, solder joint.
- 4. PVC schedule 40 (buildings not exceeding three floors above grade and approved by local and governing authority).
- B. Exposed in finished spaces:
  - 1. DWV copper with DWV fittings.
- C. Underground:
  - 1. Cast iron hub and spigot, neoprene gasket.

#### 2.9 HEAVY DUTY NO HUB COUPLINGS

- A. Use on the following:
  - 1. Sanitary vent piping 4" and larger.
  - 2. Sanitary piping 3" and larger.
  - 3. All storm piping.
- B. 1-1/2", 2", 3" and 4": 3" wide 304 stainless steel shield; (4) minimum stainless steel clamps; fixed and "floating" eyelet.
- C. 5" and over: 4" wide 304 stainless steel shield, with six (6) stainless steel clamps mounted in series.
- D. Torque to minimum 80 inch pounds or per manufacturer's recommendation.
- E. Acceptable manufacturers: Husky Series 4000 or Mission Heavy Weight.

### 2.10 STANDARD DUTY COUPLINGS

- A. Standard duty couplings shall conform to CISPI 310-85: 0.008" thick corrugated stainless steel.
- B. Use of the following:
  - 1. Sanitary vent piping up to and including 3" piping.
  - 2. Sanitary piping up to and including 2" piping.
- C. Torque to inch pounds per manufacturer's recommendation.
- D. Acceptable manufacturers: Tyler, Mission, AB&I, Clamp All, Huskey.

#### 2.11 PUMPED SANITARY PIPING (ABOVE AND BELOW GRADE)

- A. DWV copper with DWV fittings, solder joint.
- B. 125 lb. galvanized steel, threaded.
- C. Galvanized malleable or ductile iron grooved pipe fittings, designed for cut grooved joint.
- D. Hub and spigot or no hub couplings are not allowed.

#### 2.12 SOIL AND VENT PIPING PRODUCTS

A. Use approved fittings for connections between dissimilar pipe systems.

- B. Manufacturers:
  - 1. Acceptable Manufacturers:
    - a. Josam
    - b. Wade
    - c. Zurn
    - d. J.R. Smith
    - e. Jones Spec
    - f. Watts Ancon
- C. Cleanout Plugs:
  - 1. Material: Cast bronze or brass.
  - 2. Type: Countersunk.
  - 3. Threads: ANSI B2.1.
- D. Wall Cleanout Covers:
  - 1. Type: Frameless, round, low profile plate.
  - 2. Material: Stainless steel or chrome plated brass.
  - 3. Attachment: Single exposed flush screw.
  - 4. Finish:
    - a. Non-painted surfaces: Bright polished.
    - b. Surfaces to be painted: Prime coat.
- E. Floor Cleanouts:
  - 1. Body: Standard round Duco cast iron.
  - 2. Attachment: Bronze screws.
  - 3. Sleeve: Full thickness of floor slab.
  - 4. Top:
    - a. Shape:
      - 1) Where floor covering has rectangular pattern: Square.
      - 2) Other areas: Round.
  - 5. Cover:
    - a. For Vinyl Tile and Similar Floor Coverings: Recessed to receive inset of floor material.
    - b. For carpeted floor covering provide carpet cleanout marker.
    - c. Other areas: Nickel bronze scoriated finish.
- F. Exterior Cleanouts to Grade:
  - 1. Material: Duco cast iron.
  - 2. Ferrule: Caulk type.
  - 3. Plug: Cast bronze countersunk type.
- G. Vandal-Proof Caps
  - 1. Material: Duco cast iron.
  - 2. Attachment: Recessed Allen set screw.
- H. Backwater Valve:
  - 1. Material: Duco cast iron.
  - 2. Valve: Bronze.

- 3. Provide cleanout cover.
  - a. Locate in accessible manhole.
- 2.13 SANITARY SEWER PIPING (BELOW GRADE-EXTERIOR TO BUILDING)
  - A. Match material and methods specified in Division 2 for sitework sanitary sewer system or as listed below.
  - B. Use approved fittings for connections between dissimilar pipe systems.
  - C. Plastic Pipe:
    - 1. Acceptable Manufacturers:
      - a. Johns-Manville
      - b. Carlon
      - c. Robintech
    - 2. Material: PVC ASTM D3034
    - 3. Strength: SDR35

#### 2.14 MAN-HOLES

- A. Concrete Base:
  - 1. Construction: Poured in place.
  - 2. Material: 3000 lb concrete.
- B. Man-Holes:
  - 1. Construction: Pre-cast or poured in place.
  - 2. Material: ASTM C478
- C. Frames and Covers:
  - 1. Material: Grey cast iron, ASTM A48 Class 30B
  - 2. Meets or exceeds FS RR-F-621.
  - 3. Legend: Cast in "Sanitary" or "Storm" as required.
  - 4. Steps: Grey cast iron, ASTM A48 Class 30B.
- D. Type:
  - 1. Rated for H-20 (Heavy Truck) wheel loading.
  - 2. Neenah R-6099 or equivalent.
    - a. 48" clear opening or as required by application. Coordinate any alternate size with Architect/Engineer.
- 2.15 STORM WATER PIPING (INSIDE BUILDING)
  - A. Above Ground:
    - 1. Cast iron, hub and spigot, neoprene gasket joints.
    - 2. Cast iron no hub, neoprene gasket and stainless steel clamps.
    - 3. Schedule 40 galvanized steel with screwed or grooved mechanical fittings. (Optional: Welded joints)

- 4. Schedule 40 PVC (buildings not exceeding three floors above grade and approved by local and governing authority)
- B. Underground:
  - 1. Cast iron hub and spigot, neoprene gasket.

#### 2.16 STORM WATER PIPING (BELOW GROUND-EXTERIOR TO BUILDING)

- A. Match material and methods specified in Division 2 for sitework storm sewer system or as listed below.
- B. Match materials and methods specified for soil and vent piping above.
- C. Use approved fittings for connections between dissimilar pipe systems.

# 2.17 STORM DRAINAGE PRODUCTS

- A. Acceptable Manufacturers:
  - 1. Josam
  - 2. Wade
  - 3. Zurn
  - 4. Jones Spec
  - 5. Watts Ancon
  - 6. J.R. Smith
- B. Roof Drain: (RD)
  - 1. Material: Cast Iron
  - 2. Dome: Cast Iron
  - 3. Include:
    - a. Combined flashing collar and gravel stop.
    - b. Extension for insulation.
    - c. Under-deck clamp.
    - d. Sump receiver.
    - e. Expansion joint.
- C. Overflow Roof Drain: (OD)
  - 1. Same as Roof Drain Type 1 except:
    - a. Provide water dam. Top of water dam shall be 2" above low point of roof or per local code if different.
- D. Downspout Nozzle: (DSN)
  - 1. Material: Cast bronze body and flange.

#### 2.18 SAND AND OIL INTERCEPTOR

- A. Materials:
  - 1. Pre-formed or cast concrete.
- B. Capacity: See plans.

- C. Design:
  - 1. Comply with local authority having jurisdiction.
  - 2. Two compartment.
  - 3. Two access manholes with ladders and manhole covers. Covers to be cast with "Sewer". Covers to be Traffic-Rated.
  - 4. See detail shown on plans for general requirements.

#### PART 3 – EXECUTION

#### 3.1 GENERAL

- A. Testing: Test in accordance with the applicable Plumbing Code.
- B. Connections to Equipment Furnished Under Other Sections:
  - 1. Make final connections to all equipment shown on drawings as connected to supply and/or drain piping.
  - 2. Furnish all devices necessary for final connection, including:
    - a. Tail pieces
    - b. Stops
    - c. Supplies
- C. Corrosion Protection:
  - 1. Provide isolation between concrete or mortar and any copper pipe.
  - 2. All below grade piping shall be adequately protected from corrosion.
- D. Comply with Section 23 05 29 Pipe Supports and Anchors for pipe support requirements.

# 3.2 INSTALLATION OF DOMESTIC WATER PIPING AND PRODUCTS

- A. Install all horizontal water piping level and parallel to building construction (except piping noted to be drained down slope toward drain at 1/8" /ft. min.). Make any changes in direction with fittings, don't kink or bend. All vertical piping to be plumb. Provide dielectric isolation between uninsulated pipe and hangers. Provide plastic grommets when going through metal studs. Tape is not acceptable for dielectric isolation.
- B. Backflow Preventer:
  - 1. Provide backflow preventer requirements as follows:
    - a. Reduced pressure at cooling towers, and make-up for hydronic systems.
    - b. Vacuum breaker at all hose bibbs.
    - c. Reduced pressure on water entry.
- C. Water Hammer Arrestors: Install arresters as shown on the drawings. At minimum any branch line connected to a flush valve shall have one arrestor.
- D. Disinfection:
  - 1. After installation of all fixtures served, fill all domestic water lines with a chlorine-water solution of 50 parts per million minimum.
  - 2. Hold solution in pipe for at least 24 hours.
  - 3. Open and close all valves 3 times during chlorination.
  - 4. Waste chlorine solution from each outlet.

- 5. Measure solution at end. If not 10 ppm, repeat.
- E. Meters:
  - 1. Install water meter in accordance with Water Supplier's standard.

#### 3.3 INSTALLATION OF SANITARY AND VENT PIPING

- A. Couplings: See Part 2 for use of standard and heavy-duty couplings.
- B. Gaskets: Install gaskets in accordance with manufacturer's recommendations for the use of lubricants, cements, and other special installation requirements.
- C. Joint Adapters: Make joints between cast iron pipe and other types of pipe with standard manufactured cast iron adapters and fittings.
- D. Cleaning Piping:
  - 1. Clear the interior of pipe of dirt and other superfluous material as the work progresses.
  - 2. Place plugs in the end of uncompleted pipe at the end of the day or whenever work stops.
- E. Test Plugs:
  - 1. Provide test plugs in floor drains and roof drains at the time of installation.
  - 2. Leave test plugs in place for the duration of construction until sewer or drainage system is complete.
- F. Vent Flashing:
  - 1. Provide 4 lb. sheet lead (24" x 24" minimum).
  - 2. Extend lead 5" above the vent and turned down into vent pipe.
  - 3. Refer to Section 7600 for single ply roof system components.
- G. Vent Location: Do not install vents within 2 ft. of roof edge, parapet, wall line, or an "on-the-roof structure" and within 10 ft. of any air intake.
- H. Sand/Oil Interceptors and Traps:
  - 1. Provide solid unexcavated earth or concrete support under interceptors.
  - 2. Do not support interior traps from floor extension.

#### 3.4 INSTALLATION OF STORM DRAINAGE PIPING (ABOVE GROUND WITHIN BUILDING)

- A. Couplings:
  - 1. Utilize heavy duty, 8 psi, no-hub couplings for cast iron. No-hub may only be used on piping within 20' below the roof. This limitation is to prevent a failure of the 8 psi rated couplings in the event of a downstream system blockage. In lieu of this restriction adequate relief or a higher rated coupling, must be provided and approved by the engineer.
  - 2. Threaded or mechanical couplings with galvanized piping are acceptable for all locations.
- B. Gaskets: Install gaskets in accordance with manufacturer's recommendations for the use of lubricants, cements, and other special installation requirements.
- C. Joint Adapters: Make joints between cast iron pipe and other types of pipe with standard manufactured cast iron adapters and fittings.

- D. Cleaning Piping:
  - 1. Clear the interior of pipe of dirt and other superfluous material as the work progresses.
  - 2. Place plugs in the end of uncompleted pipe at the end of uncompleted pipe at the end of the day or whenever work stops.
- E. Test Plugs:
  - 1. Provide test plugs in floor drains and roof drains at the time of installation.
  - 2. Leave test plugs in place for the duration of construction.
- F. Roof Drains:
  - 1. Install drains on the center line of sheet lead pan.
  - 2. Clamp flashing into drain flashing collar.
  - 3. Install domes immediately after completion of roof installation.
- G. Expansion:
  - 1. Provide a vertical expansion joint at each connection to roof drain unless an offset is provided.
  - 2. Where piping crosses building expansion joints, provide swing or expansion joints to allow for building movement.
- H. Downspout Nozzles: Install with flange secured to wall at base of concealed storm leaders that discharge through the building wall above grade.
- I. Provide sway bracing and anchorage of piping as required by local code. At a minimum provide sway bracing at changes of direction greater than 45 degrees for pipes 4" or larger.

# 3.5 INSTALLATION OF SANITARY SEWER AND STORM WATER PIPING (EXTERIOR TO BUILDING)

- A. Couplings: See Part 2 for use of couplings.
- B. Lay piping true to the grades and alignment indicated with unbroken continuity of invert.
- C. Install gaskets in accordance with manufacturer's recommendations for the use of lubricants, cements and other special installation requirements.
- D. Install plastic pipe in accordance with pipe manufacturer's written instructions.
- E. Install cast iron hub and spigot pipe under roads and paved areas.
- F. Clear the interior of piping of dirt and other superfluous material as the work progresses. Maintain a swab or drag in the line and pull past each joint as it is completed.
- G. Place plugs in the end of uncompleted conduit at the end of the day or whenever work stops.
- H. Flush lines if required to remove collected debris.
- I. Make joints between cast iron pipe and other types of pipe with standard manufactured cast iron adapters and fittings.
- J. Grout joints between cast iron pipe and concrete pipes thoroughly with cement mortar to make watertight joint.
- K. Inspect conduit to determine whether line displacement or other damage has occurred.
  - 1. Make inspection after lines between manholes, or manhole locations, have been installed and approximately 2 ft. of backfill is in place and at completion of the project.

- L. If the inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, take whatever steps are necessary to correct such defects to the satisfaction of the Architect/Engineer.
- M. Set grade cleanouts located in unpaved and asphalt paved areas in 12" x 12" x 4" concrete pad.
  - 1. Provide concrete pad.

#### 3.6 MANHOLES

- A. Precast Concrete Manholes:
  - 1. Place precast concrete sections as shown on the drawings.
  - 2. Where manholes occur in pavements, set tops of frames and covers flush with finish surface.
  - 3. Elsewhere, set tops 3" above finish surface unless otherwise indicated.
- B. Provide rubber joint gasket complying with ASTM C443.
- C. Apply bituminous mastic coating at joints of sections.

# 3.7 TRAP PRIMERS

A. Install all trap primers and required distribution units as shown on plans and as required by manufacturers recommendations.

# 3.8 TRAP GUARDS

A. Install elastmeric trap guards in specified floor and sink drains as indicated on plans.

# SECTION 22 21 23 - NATURAL GAS SYSTEMS

PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Furnish and Install:
  - 1. Natural gas piping.
  - 2. Valves and specialties.
- B. Gas Meter: The gas meter and piping upstream of meter will be provided by the Gas Utility Company and paid for by this Contractor.

# 1.2 SUBMITTALS

- A. Manufacturer's Product Data: Submit for:
  - 1. Gas cocks.
  - 2. Gas meter.
  - 3. Emergency shut-off valves and relays.
  - 4. Pressure reducing valves.

### PART 2 – PRODUCTS

#### 2.1 NATURAL GAS PIPING

- A. 2 Inch and Smaller: Schedule 40 black steel with 150 lb. malleable iron threaded fittings.
- B. Over 2 Inch: Schedule 40 black steel with standard weight steel butt weld fittings and welded joints.
- C. Underground pipe shall be coated with PVC.
  - 1. Pipe shall be listed by IAPMO, and bear the UPC logo.
  - 2. Fittings shall be wrapped with PVC tape.
  - 3. Tape shall conform to IAPMO Standard PS 22-84.
  - 4. Provide cathodic protection where required by the local authority having jurisdiction.
- D. All piping within return air plenums or concealed (unaccessible) in building construction shall be as called for piping over 2".

# 2.2 NATURAL GAS PIPING

- A. Above Ground:
  - 1. Two Inch and Smaller:
    - a. Pipe: Schedule 40 black steel.
    - b. Fittings: 150 lb. malleable iron, threaded.
  - 2. Over Two Inch:
    - a. Pipe: Schedule 40 black steel, plain end.
    - b. Fittings: Standard weight, butt weld.

- Β. Underground:
  - Pipe: Schedule 40 black steel, ASTM A53, Grade B, seamless, plain end. 1. 2.
    - Fittings: Standard weight, steel.
      - a. Two Inches and Smaller: Socket weld.
      - b. Over Two Inch: Butt weld.
  - 3. Coating:
    - Pipe: AAPCA TGF-3. a.
    - b. Fittings: Protecto Wrap No. 200.
      - 1) Primer: No. 1170

#### 2.3 GAS COCKS

Description: Corrosion-resistant plug, permanently lubricated, corrosion-resistant bearings, suitable Α. seals for intended service, lever operator.

#### 2.4 PRESSURE REGULATING VALVES

- Α. Size of gas distribution piping system is based on a gas supply pressure of 10" WC. Provide gas fired equipment with gas pressure regulators of size and capacity required to reduce gas pressure to proper operating pressure.
- Β. Route vent line from PRV to outside.

#### 2.5 EMERGENCY GAS VALVES AND CONTROL STATIONS

- Α. Control Station: ASCO No. 108D906, key operated to open switch, pushbutton to close with pilot light.
  - 1. Stainless steel face plate for flush mounting.
  - 2. "GAS VALVE CONTROL" to be inscribed on the plate.
  - 3. Key switch labeled "ON".
  - Pushbutton labeled "OFF". 4.
- Β. Valve: ASCO No. 8215, 2-way solenoid, 110 volt, 60 Hz, AC.
  - 1. Normally closed.

#### 2.6 GAS OUTLET

- Α. Manufacturers:
  - 1. Apollo
  - 2. Legend
  - Milwaukee 3.
- В. Description:
  - 1. AGA and/or UL certified for use with natural gas.
  - 2. Ball valve, non lubricated.
  - soft seats, suitable for tight shut-off with low pressure. 3.

# PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Remove cutting and threading burrs before assembling piping.
- B. Do not install defective piping or fittings.
- C. Do not use pipe with threads which are chipped, stripped or damaged.
- D. Use teflon tape on male pipe threads.
- E. Plug each gas outlet, including valves with a threaded plug or cap, immediately after installation, and retain until continuing piping or equipment connection is completed.
- F. Do not install any valves or unions inside concealed areas or above ceiling in building.
- G. Vent gas PRV's outside the building in accordance with local code.
- H. Paint all exposed gas pipe with a minimum of 2 coats on rust resistant pipe.

# 3.2 BURIED PIPE

- A. Coated Pipe: Follow IAPMO Standard IS 13-84.
- B. Buried piping shall be buried 24" minimum.
  - 1. All buried joints shall be welded and left exposed until testing has been completed.

#### 3.3 EMERGENCY SHUT-OFFS

- A. Install emergency shut-off valves where shown.
- B. Deliver switches and relays to Installer of electrical work.

# 3.4 TEST

- A. Prior to initial operation, test and purge fuel gas piping in accordance with local code requirements or the National Fuel Gas Code.
  - 1. Test at 65 psig minimum.
  - 2. Repair or replace piping as required to eliminate leaks, and re-test.

# SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

# 1.1 SUBMITTALS

- A. Submit manufacturer's product data for plumbing fixtures and accessories, in accordance with Division 1.
- PART 2 PRODUCTS

#### 2.1 GENERAL

- A. All manufacturers are listed in alphabetical order and not by preference.
- B. Provide factory fabricated fixtures.
- C. Provide trim, carriers, valves and accessories as required for complete installation.
- D. All carriers are floor mounted unless otherwise noted. All carriers shall be bolted down to floor structure.
- E. Refer to Drawings for "Plumbing Fixture Schedule".
- F. Comply with Local, State and Governing ordinances concerning maximum water requirements of plumbing fixtures: Tank type W.C. and flush valve type W.C. = 1.28 gal./flush; lavs = 0.5 GPM; urinals = 0.125 gal./flush and showers = 1.5 gal. maximum.
- G. All valves, fixtures and accessories in contact with domestic water shall meet the requirements of NSF/ANSI Standard 61.

#### 2.2 FLOOR SINK, FS-1

- A. Acceptable Manufacturers:
  - 1. Josam
  - 2. JR Smith
  - 3. Wade
  - 4. Zurn
  - 5. Watts Ancon
- B. Body: Cast iron with acid-resisting porcelain enameled interior.
- C. Rim and Grate: Nickel bronze
- D. Flashing Flange: Provide

#### 2.3 FLOOR DRAINS

- A. Acceptable Manufacturers:
  - 1. Josam
  - 2. JR Smith
  - 3. Wade
  - Zurn
     Watts Ancon
- B. Body: Duco cast iron, with flashing collar.
- C. Grates and sediment strainers as specified in schedule.

D. Provide primer taps as specified in schedule.

#### 2.4 EQUIPMENT FURNISHED UNDER OTHER SECTIONS

- A. Provide all materials necessary to make final connections to owner equipment furnished under other Sections of these Specifications including:
  - 1. Tail pieces
  - 2. Stops
  - 3. Supplies
  - 4. P traps, standard and/or offset
  - 5. Escutcheons

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. General: Install each fixture with P trap with cleanout plug, easily removable for servicing and cleaning.
- B. Provide chrome plated, rigid or flexible supplies to fixtures with stops, reducers and escutcheons.
- C. Finish wall and floor penetrations when exposed to view in finished areas with set screw type, chrome plated brass escutcheons.
- D. Set plumbing fixtures level and plumb, spaced in accordance with architectural dimensioned drawings, and securely install to be rigid.
- E. Install wall mounted lavatories, urinals and water closets with wall carriers mounted to the floor.
- F. Solidly attach floor mounted carriers for all fixture to floor using proper fasteners based on floor construction.
- G. Cover fixture bolts with china bolt caps of the same color where required.
- H. All wall mounted fixtures to be caulked between fixture and wall.
- I. Securely anchor flush valves behind or within walls to be rigid and not subject to movement due to push or pull action on the valve.
- J. Fixture Mounting Heights:
  - 1. Refer to Architectural drawings and ADA standards.
- K. Floor Drains:
  - 1. Refer to Architectural drawings for exact locations and additional installation requirements.
  - 2. Install floor drains with P-traps and vent as required.
  - 3. Install drains on the center line of sheet lead pan and/or membrane in waterproofed areas and in floors above lowest floor.
  - 4. Clamp pan and/or membrane into drain flashing collar.
  - 5. Install strainers immediately after completion of finish floor installation.
  - 6. Coordinate locations with mechanical equipment.
  - 7. Install trap primers as indicated.

#### 3.2 ADJUSTING AND CLEANING

- A. Cleaning:
  - 1. Clean strainers, traps, aerators, and valves of debris, sand and dirt.
  - 2. At completion, thoroughly clean plumbing fixtures and equipment.

B. Adjusting: After cleaning and flushing operations are accomplished, adjust flush valves, faucets, showers, bubblers for proper flow.

#### 3.3 PROTECTION

- A. Protect fixtures and related components from damage before, during, and after installation to date of Final Acceptance or Owner move-in. Provide protective coverings or other protection as required.
- B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit.
- C. Feasibility and match to be judged by Architect or Engineer.
- D. Remove cracked or dented units and replace with new units.
- E. Contractor shall be responsible for replacing damaged fixtures or components.

SECTION 229000 -PLUMBING PROJECT CLOSEOUT

PART 1 – GENERAL

- 1.1 REFER TO RELATED SECTIONS
  - A. Section 23 90 00 Project Closeout

PART 2 – NOT USED

PART 3 - NOT USED

# SECTION 230501 - MECHANICAL AND ELECTRICAL COORDINATION

PART 1 - GENERAL

#### 1.1 RESPONSIBILITY

- A. The Divisions 22 through 23 and 26 through 28 contractor(s) shall comply with the provisions of this section. The Divisions 22 through 23 contractor(s) shall verify electrical service provided by the electrical contractor before ordering any mechanical equipment requiring electrical connections. Provide submittals of all mechanical equipment to Division 26 through 28 contractor(s).
- B. The final responsibility for properly coordinating the electrical work of this section shall belong to the Divisions 22 through 23 system contractor performing the work, which requires the electrical power.
  - 1. Each Divisions 22 through 23 contractor shall be responsible for providing power wiring for certain devices as described in the specifications and on the drawings. This work shall be provided by a licensed electrician in accordance with all of the applicable provisions of the Division 26 through 28 specifications, NEC and local codes.

#### 1.2 WORK INCLUDED

A. Carefully coordinate the interface between Divisions 22 through 23 (Mechanical) and Divisions 26 through 28 (Electrical), and Division 23 09 00 (Building Management and Automatic Temperature Control Systems) before submitting any equipment for review or commencing installation.

#### 1.3 DEFINITIONS

- A. Automatic: Pertaining to a function, operation, process or device that, under specified conditions, functions without intervention by human operator.
- B. Disconnect Switch: A mechanical switching device used for changing the connections in a circuit, or for isolating a circuit or equipment from a power source.
- C. Motor Control Center: A floor mounted assembly of one or more enclosed vertical sections having a common horizontal power bus and primarily containing motor starting units.
- D. Control Circuit/Power: The circuit which carries the electrical signals of a control apparatus or system directing the performance of the controller but does not carry the main power circuit.
- E. Manual Operation: Operation by hand without the use of any other power.
- F. MC: Mechanical Contractor = Divisions 22 through 23 Contractor who furnishes motor.
- G. TC: Temperature Controls = Division 23 09 00 Contractor who furnishes control.
- H. EC: Electrical Contractor = Divisions 26 through 28 Contractor.
- I. FA: Fire Alarm Contractor = Division 28 Contractor who furnishes Fire Alarm System.
- J. EP: Electric to Pneumatic Converter.
- K. PE: Pneumatic to Electric Converter.

# 1.4 RESPONSIBILITY SCHEDULE

A. Responsibility: Unless otherwise indicated, all motors and controls for Divisions 22 through 23 equipment shall be furnished, set in place and wired in accordance with the following schedule:

# DENVER TRAFFIC OPERATIONS COMMAND VEHICLE STORAGE & MODIFICATIONS

| ITEM -                                              | Furnished          | Set In           | Power         | Control    |
|-----------------------------------------------------|--------------------|------------------|---------------|------------|
|                                                     | Under              | Place            | Wiring        | Wiring     |
|                                                     |                    | Under            | Under         | Under      |
| MC: Mechanical Contractor TC: Temperature Contract  | ctor EC: Electrica | al Contractor F. | A: Fire Alarm | Contractor |
| Equipment Motors                                    | MC                 | MC               | EC            |            |
| Automatically or Manually Controlled                |                    |                  |               |            |
| Starters/Contactors: (Note 4)                       |                    |                  |               |            |
| -Separate                                           | MC                 | EC               | EC            | TC         |
| -Factory Mounted and Wired                          | MC                 | MC               | EC            | TC         |
| In Motor Control Centers (Note 4)                   | EC                 | EC               | EC            | TC         |
| Motor Speed Controllers: (Note 4)                   |                    |                  |               |            |
| -Separate                                           | MC                 | EC               | EC            | TC         |
| -Factory Mounted and Wired                          | MC                 | MC               | EC            | TC         |
| Disconnect Switches (Note 1)                        | EC                 | EC               | EC            |            |
| Thermal Overload Switches (Note 1)                  | EC                 | EC               | EC            |            |
| Switches (Manual or Automatic other than            | MC or TC           | MC or TC         | EC or TC      | TC or MC   |
| disconnect) (Note 2)                                |                    |                  |               |            |
| Control Relays (Note 2)                             | MC or TC           | MC or TC         |               | TC         |
| Control Transformers                                | MC or TC           | MC or TC         | EC or TC      | TC         |
| Push Button Stations, Pilot Lights                  | MC                 | EC               | EC            | EC         |
| Thermostat and Controls: Integral with Equipment or | MC or TC           | EC or TC         | EC or TC      | TC         |
| Directly Attached to Ducts, Pipes, etc. (Note 2)    |                    |                  |               |            |
| Equipment in Temperature Control Panels             | TC                 | TC               | TC            | TC         |
| Standalone Control Panels                           | TC                 | TC               | TC            | TC         |
| (BAS) (Note 3)                                      |                    |                  |               |            |
| Valve Motors, Damper Motors, Solenoid Valves, etc.  | TC                 | TC               | TC            | TC         |
| EP Valves or Switches,                              | TC                 | TC               |               | TC         |
| P.E. Switches, etc.                                 |                    |                  |               |            |
| Duct System                                         | FA                 | MC               |               | TC/FA      |
| Smoke Detectors (Note 5)                            |                    |                  |               |            |
| Relays for Fan Control via duct detectors (Note 5)  | MC                 | MC               | EC            | TC         |
| Room Smoke Detectors Including                      | FA                 | FA               |               | FA         |
| Relays for Fan Control (Note 3)                     |                    |                  |               |            |
| CO Sensors                                          | TC                 | TC               | TC            | TC         |
| Equipment Interlocks                                | TC                 | TC               |               | TC         |
| Fire/Smoke and Smoke Dampers                        | MC                 | MC               | EC            | FA         |

Notes:

- 1. If furnished as part of factory wired equipment furnished and set in place by MC, wiring and connections by EC.
- 2. If float switches, line thermostats, P.E. switches, time switches, or other controls carry the FULL LOAD CURRENT to any motor, they shall be furnished by MC, but they shall be set in place and connected by EC, except that where such items are an integral part of the mechanical equipment, or directly attached to ducts, piping, or other mechanical equipment, they shall be furnished and set in place by MC and connected by EC. If they do not carry the FULL LOAD CURRENT to any motor, they shall be furnished, set in place and wired by TC contractor.
- 3. Each division shall be fully responsible for any control panels as called for on the drawings or specifications.
  - a. Division 26 shall provide all power and control wiring to fire/smoke or smoke dampers. Division 23 and 26/28 shall provide parallel control wiring (with 28 fire alarm having priority signal) to dampers and equipment utilized in both normal and smoke control modes. Refer to Smoke Control and Fire Alarm Drawings and the Fire Alarm Matrix.
  - b. Fire alarm system shall override automated building control system during smoke exhaust mode.
  - c. TC wiring required only when damper also serves HVAC system.
- 4. Electrical contractor is responsible for wiring from starter to motor, unless factory wired.

- 5. Temperature control contractor shall provide conduit and wire from auxiliary contact in motor starter to the detector so that the unit shuts down in all operating modes. Fire Alarm Contractor to wire from detector to fire alarm panel.
- B. Power Wiring by Divisions 22 through 23: The electrical power for certain equipment provided under Divisions 22 through 23 has not been specifically indicated on the electrical drawings and must be provided by and field coordinated by the Divisions 22 through 23 trade requiring such power.

Sufficient power for this purpose shall be furnished as "spare" dedicated circuit capacity in Division 26's panelboards. All wiring, conduit and electrical devices downstream of the panelboards is the responsibility of the Divisions 22 through 23 trade requiring the power.

- 1. Such equipment is hereby defined as:
  - a. Electrical heat trace. Required heat trace locations, capacities and specification are shown on the plumbing drawings (Division 22 work).
  - b. Infrared plumbing fixtures. Fixtures requiring power are shown on the plumbing drawings and schedules. Provide junction box and or receptacle as required by manufacturer.
  - c. Temperature control panels, control air compressors and line voltage power for 24v control transformers. Required connections are included in Division 23 09 00 and will be shown by that contractor's control submittal drawings.

# 1.5 GENERAL REQUIREMENTS

- A. Connections:
  - 1. Connections to all controls directly attached to ducts, piping and mechanical equipment shall be made with flexible connections.
- B. Starters:
  - 1. Provide magnetic starters for all three phase motors and equipment complete with:
    - a. Control transformers.
    - b. 120V holding coils.
    - c. Integral hand-off-auto switch.
    - d. Auxiliary contacts required for system operation plus one (1) spare.
    - e. Refer to Section 23 05 13 Motors, Starters and Drives.
- C. Remote Switches and Pushbutton Stations:
  - 1. Provide remote switches and/or pushbutton stations required for manually operated equipment (if no automatic controls have been provided) complete with pilot lights of an approved type lighted by current from load side of starter.
- D. Special Requirements:
  - 1. Motors, starters and other electrical equipment installed in moist areas or areas of special conditions, such as explosion proof, shall be designed and approved for installation in such areas with appropriate enclosure.
- E. Identification:
  - 1. Provide identification of purpose for each switch and/or pushbutton station furnished. Identification may be either engraved plastic sign permanently mounted to wall below switch, or stamping on switch cover proper. All such identification signs and/or switch covers in finished areas shall match other hardware in the immediate area.
- F. Control Voltage:
  - 1. Maximum allowable control voltage 120V. Fully protect control circuit conductors in accordance with National Electrical Code.

# G. DDC Control Interface:

- 1. Fully coordinate the requirements of each division with regard to supplying a complete DDC Control System prior to submitting bid.
- 2. All control power shall be furnished via dedicated line voltage circuits.
- 3. Dedicated control circuits from electrical panelboards to DDC control panels and from electrical panelboards to dedicated DDC J-boxes (for distributed control components such as VAV boxes), and control transformer line voltage connections shall be provided under Division 23 09 00 where required and as shown on the drawings.
- 4. Low voltage wiring from J-boxes to distributed control components, all low voltage connections, all control panels and all control transformers (not part of unitary equipment) shall be provided under Division 23 09 00.
- 5. Any additional power requirements shall be the responsibility of the Division 23 09 00 Contractor requiring same, and provided at no additional cost to the owner.

# 1.6 CEILING AND CHASE CAVITY PRECEDENCE

- A. Coordinate ceiling cavity space carefully with all trades. In the event of conflict, install mechanical and electric systems within the cavity space allocation in the following order of precedence. A system with higher precedence may direct that systems of lower precedence be relocated from space, which is required for expedient routing of the precedent system.
  - 1. Plumbing waste, cooling coil drain piping, and roof drain mains and leaders.
  - 2. Hydronic main piping.
  - 3. Plumbing vent piping.
  - 4. Supply, return and exhaust ductwork.
  - 5. Electrical conduit greater than 4" diameter.
  - 6. Domestic water piping.
  - 7. Fire sprinkler mains and leaders.
  - 8. Hydronic branch piping (2" and less).
  - 9. Domestic hot and cold water branches.
  - 10. Electrical conduit branch feeders.
  - 11. Fire sprinkler branch piping and sprinkler runouts.
- B. Light fixtures have precedence in a zone, which is the same height above the ceiling as the depth of the fixture (plus 2").
- C. Examine the contract documents of all trades (e.g. all Divisions 22 through 23 and 26 through 28 drawings, the architectural floor plans, reflected ceiling plans, elevations and sections, structural plans and sections, etc.).
- D. Coordinate necessary equipment, ductwork and piping locations so that the final installation is compatible with the materials and equipment of the other trades.
- E. Prepare shop drawings for installation of all new work before installation to verify coordination of work between trades.
- F. Provide access doors for all equipment, valves, clean-outs, actuators and controls which require access for adjustment or servicing and which are located in otherwise unaccessible locations.
  - 1. For equipment located in "accessible locations" such as lay-in ceilings: Locate equipment to provide adequate service clearance for normal maintenance without removing architectural, mechanical, electrical or structural elements such as the ceiling support system, electrical fixtures, etc. "Normal maintenance" includes, but is not limited to: filter changing; greasing of bearings; using p/t ports for pressure or temperature measurements; and replacement of ballasts, fuses, etc.

# PART 2 – PRODUCTS

# 2.1 MOTOR HORSEPOWER

- A. In general, all motors <sup>3</sup>/<sub>4</sub> HP and above shall be three phase, all motors <sup>1</sup>/<sub>2</sub> HP or less shall be single phase.
- B. Voltage and phase of motors as scheduled on the electrical drawings shall take precedence in the case of a conflict between the mechanical and electrical drawings or general condition 2.1. A., above.
- C. Work under Divisions 22 through 23 includes coordinating the electrical requirements of all mechanical equipment with the requirements of the work under Divisions 26 through 28, before ordering the equipment.
  - If motor horsepowers are changed under the work of Divisions 22 through 23 without a change in duty of the motor's driven device, coordination of additional electrical work (if any) and additional payment for that work (if any) shall be provided under the section of Divisions 22 through 23 initiating the change. Increases or decreases in motor horsepower from that specified shall not be made without written approval from the Architect/Engineer.

PART 3 - EXECUTION - (Not Used)

END OF SECTION 230501

# SECTION 230502 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

- A. This Section supplements Division 1 General Requirements.
- B. Where contradictions occur between this Section and Division 1, the more stringent of the two shall apply. Architect/Engineer shall decide which is more stringent.
- C. Provisions of this section shall also apply to all sections of Divisions 22 through 23.

#### 1.2 DEFINITIONS

- A. The definitions of Division 1 and the General Conditions of this specification also apply to Divisions 22 through 23 contract.
- B. "Contract Documents" constitute the drawings, specifications, general conditions, project manuals, etc., prepared by Engineer (or other design professional in association with Engineer) for contractor's bid or contractor's negotiations with the Owner. Divisions 22 through 23 drawings and specifications prepared by the Engineer are not construction documents.
- C. "Construction Documents", "construction drawings", and similar terms for Divisions 22 through 23 work refer to installation diagrams, shop drawings and coordination drawings prepared by the contractor using the design intent indicated on the Engineer's contract documents. These specifications detail the contractor's responsibility for "Engineering by Contractor" and for preparation of construction documents.
- D. "(N)" indicates "new" equipment to be provided under this contract.
- E. "(E)" indicates "existing" equipment on site which may or may not need to be relocated as a part of this work.
- F. "(R)" indicates existing equipment to be relocated as part of this work.
- G. "Furnish" means to "supply" and usually refers to an item of equipment.
- H. "Install" means to "set in place, connect and place in full operational order".
- I. "Provide" means to "furnish and install".
- J. "Equal" or "Equivalent" means "meets the specifications of the reference product or item in all significant aspects." Significant aspects shall be as determined by the Architect/Engineer.
- K. "Work by other(s) divisions"; "re:\_\_\_\_\_ Division", and similar expressions means work to be performed under the contract documents, but not necessarily under the division or section of the work on which the note appears. It is the contractors sole responsibility to coordinate the work of the contract between his/her suppliers, subcontractors and employees. If clarification is required, consult Architect/Engineer before submitting bid. By inference, any reference to a "contractor" or "sub-contractor" means the entity, which has contracted with the Owner for the work of the Contract Documents.
- L. By inference, any reference to a "contractor" or "sub-contractor" means the entity, which has contracted with the owner for the work of the Contract Documents.

M. "Engineer" means the design professional firm, which has prepared these contract documents. All questions, submittals, etc. of this division shall be routed to the Engineer (through proper contractual channels).

## 1.3 COORDINATION WITHIN DIVISIONS 22 THROUGH 23

- A. Contract Documents:
  - General: The Contract Documents are diagrammatic showing certain physical relationships, which must be established within the Divisions 22 through 23 work and its interface with other work. Such establishment is the exclusive responsibility of the Contractor. Drawings shall not be scaled for the purpose of establishing material quantities.
  - 2. Supplemental Instructions: The exact location for some items in this Specification may not be shown on the Drawings. The location of such items may be established by the Architect/Engineer during the progress of the work.
  - 3. Discrepancies:
    - a. Examine Drawings and Specifications of all Divisions of the work.
    - b. Report any discrepancies to the Architect/Engineer and obtain written instructions before proceeding.
    - c. Should there be a conflict within or between the Specifications or Drawings, the most stringent or higher quality requirements shall apply.
    - d. Items called for in either specifications or drawings shall be required as if called for in both.
  - 4. Constructability:
    - a. Examine Drawings and Specifications of all Divisions of the work.
    - b. Report any issues to the Architect/Engineer which may prevent installation of Divisions 22 through 23 work in accordance with the Contract Documents and the original construction contract.
    - c. Report all issues within <u>90 days</u> after contract.
- B. Be responsible for providing proper documentation of equipment product data and shop drawings to all entities providing service. This coordination shall include, but not be limited to the following:
  - Division 23 09 00 and 23 05 93 Contractors (Automatic Temperature Controls, Building Management and Test-Adjust-Balance Contractors) shall be provided with equipment product data and shop drawings as appropriate from other Division 22 through 23 and Divisions 26 through 28 contractors, and shall furnish the same information about control devices (such as valves, test wells, etc.) to the appropriate Divisions 22 through 23 Contractor.
- C. Coordination Drawings:
  - 1. Submit coordination drawings for all Divisions 22 through 23 work. The drawings shall be fully coordinated and signed off by all affected trades prior to submission. The coordination drawings shall include the following at a minimum.
    - a. All major ductwork, piping, conduit and equipment.
    - b. Reflected ceiling plans with light fixtures.
    - c. Current architectural floor plans.
    - d. Major structural elements.
    - e. Elevations of piping ductwork or equipment.
    - f. Sections through critical spaces.
  - 2. The drawings shall be at a suitable scale (1/8"=1'-0" minimum) to clearly show information.
  - 3. Any work installed without approved coordination drawings is done at the Contractor's risk.

- D. CAD Drawings:
  - 1. Electronic Auto Cad drawings are available for purchase from M-E Engineers.
- E. Existing Conditions:
  - 1. Inspect existing conditions prior to bidding.
  - 2. Provide proper coordination of mechanical work with existing conditions.
- F. Utility Connections:
  - 1. Coordinate the connection of mechanical system with the Civil drawings and utility companies.
  - 2. Comply with regulations of utility suppliers.
  - 3. The Contract Documents indicate the available information on existing utilities and services, and on new services (if any) to be provided to the project by utility companies and agencies.
    - a. Notify Architect/Engineer immediately if discrepancies are found.
  - 4. Coordinate mechanical utility interruptions one week in advance with the Owner and the Utility Company.
    - a. Plan work so that duration of the interruption is kept to a minimum.

# 1.4 COORDINATION WITH OTHER DIVISIONS

- A. General:
  - 1. Coordinate Divisions 22 through 23 work to the progress of the work of other trades.
  - 2. Complete the entire installation as soon as the condition of the building will permit.
- B. Coordinate ceiling cavity space carefully with all trades. In the event of conflict, install mechanical and electric systems within the cavity space allocation in the following order:
  - 1. Plumbing waste, cooling coil drain, piping and roof drain mains and leaders.
  - 2. Steam and condensate piping.
  - 3. Hydronic main piping.
  - 4. Plumbing vent piping.
  - 5. Supply, return and exhaust ductwork.
  - 6. Electrical conduit greater than 4" diameter.
  - 7. Domestic water piping.
  - 8. Fire sprinkler mains and leaders.
  - 9. Hydronic branch piping (2" and less).
  - 10. Domestic hot and cold water branches.
  - 11. Electrical conduit branch feeders.
  - 12. Fire sprinkler branch piping and sprinkler runouts.
- C. Coordination with Electrical Work. Refer to Section 23 05 01.
- D. Cutting and Patching: Refer to Division 1 and Section 23 05 03.
- E. Chases, Inserts and Openings:
  - 1. Provide measurements, drawings, and layouts so that openings, inserts and chases in new construction can be built in as construction progresses.
  - 2. Check sizes and locations of openings provided.
    - a. Any cutting and patching made necessary by failure to provide measurements, drawings, and layouts at the proper time shall be done at no additional cost to the Owner.
    - b. Coordinate roof openings for all roof-mounted equipment. Openings on documents are diagrammatic and do not represent manufacturer specific

requirements. Actual opening size, orientation and location, as well as structural coordination, is the responsibility of the mechanical contractor. Provide transitions on ductwork to accommodate actual roof openings.

- c.
- F. Support Dimensions: Provide dimensions and drawings so that concrete bases and other equipment supports to be provided under other Sections of the Specifications can be built at the proper time.

#### 1.5 COORDINATION WITH EXISTING OCCUPIED AREAS

- Α. Minimize disruptions to operation of mechanical systems in occupied areas.
- B. Coordinate any required disruptions with the Owner, one week in advance.
- C. Provide temporary connections to prevent long disruptions.

#### 1.6 ENGINEERING BY CONTRACTOR

- The construction of this building requires the contractor to design several systems or subsystems. Α. All such designs shall be the complete responsibility of the contractor.
- Β. Systems or subsystems which require engineering responsibility by the contractor include, but are not limited to:
  - Any system not fully detailed on the drawings. 1.
  - 2. Fire sprinkler.
  - 3. Equipment supports, and hangers not fully detailed in the drawings.
  - Pipe hangers and anchors not specified in these documents, or cataloged by the 4. manufacturer.
  - 5. Duct supports, hangers and miscellaneous steel as required.
  - Temperature controls. 6.
  - Refrigeration systems. 7.
  - 8. Piping expansion and contraction provisions.
  - Equipment supports, hangers. 9

#### 1.7 REGULATORY REQUIREMENTS

- A. Codes: Comply with the following:
  - International Building Code 2009. 1.
  - International Mechanical Code 2009. 2.
  - International Plumbing Code 2009. 3.
  - National Electric Code. 4.
  - 5. ASME Boiler and Pressure Vessel Code.
  - City and County of Denver Modifications to above Codes. 6.
- В. Applicable pamphlets of NFPA.
- C. Requirements of Local Utility Companies:
  - 1 Comply with rules and regulations of local utility companies. Include in bid the cost of all valves, valve boxes, meter boxes, meters and such accessory equipment which will be required for the project.
- D. Other Regulations: Comply with the latest editions of the following:
  - 1. U.S. and State Department of Labor Safety Regulations pertaining to the completed project.
  - 2. Requirements of Fire Departments serving the project.
  - 3. Regulations of the Health Department having jurisdiction.
  - Regulations of the Office of State Fire Marshal. 4.
  - ASHRAE Energy Conservation Standard 90A. 5.
  - ASHRAE Ventilation Standard 62. 6.

- 7. Requirements of the State Oil Inspector.
- 8. Americans with Disabilities Act (ADA).
- 9. Clean Air Act.
- 10. Colorado Air Quality control Commission Regulation #15.
- 11. Clean Water Act.
- E. Additional Regulations: Follow additional regulations, which appear in individual Sections of these Specifications.
- F. Contradictions: Where codes are contradictory, follow the most stringent, unless otherwise indicated in Plans or Specifications. Architect/Engineer shall determine which is most stringent.
- G. Contract Documents Not in Compliance:
  - 1. Where the Drawings and Specifications do not comply with the minimum requirements of the Codes, either notify the Architect/Engineer, in writing during the Bidding Period, of the revisions required to meet Code requirements, or provide an installation which complies with the Code requirements. After entering into contract, Contractor will be held to complete all work necessary to meet these requirements without additional expense to the Owner.
  - 2. Follow Drawings and Specifications where they are superior to Code requirements.
- H. Permits:
  - 1. Obtain all permits required by authorities and agencies having jurisdiction for the work of this Division.
  - 2. Post permits as required.
- I. Tap and Connection Fees:
  - 1. Pay fees charged by Utilities for making connections, bringing service to property line, or to meter and similar services.
  - 2. Investment fees or plant development fees, which are charges levied by Utilities to cover the cost of the utility system to be born by this project, are not part of the work of this Division.
- J. Inspections and Tests:
  - 1. Arrange for all required inspections and tests.
  - 2. Pay all charges.
  - 3. Notify Architect/Engineer 48 hours before tests.
  - 4. Submit one copy for Owners records of permits, licenses, inspection reports and test reports.

#### 1.8 RECORD DRAWINGS

- A. General Recording Procedure:
  - 1. Maintain a blue-line set of Divisions 22 through 23 Contract Drawings in clean, undamaged condition, for mark-up of installations, which vary, substantially from the Contract Drawings.
  - 2. Record changes drawn to scale and fully dimensioned, as specified in Division 1.
    - a. Work concealed behind or within other work, in an inaccessible arrangement.b. Mains and branches of piping systems:
      - b. Mains and branches of piping systems.
        - 1) with valves and control devices located and numbered.
        - 2) with concealed unions located.
        - 3) with items requiring maintenance located (traps, strainers, expansion compensators, tanks, etc.).
      - c. Underground piping and ducts, both exterior and interior.
      - d. Ductwork layouts, including locations of coils, dampers, filters, boxes and similar units.
      - e. Concealed control system devices and sensors.

B. Corrected Drawings:

2.

- 1. Obtain a set of contract drawings on CAD.
  - Update the CAD files to reflect as-built conditions.
- 3. Transmit corrected CAD files and plots as a submittal to the Architect/Engineer for Owner's use and record.
- C. Temperature Control Drawings:
  - 1. Indicate as-built conditions of work under this contract including:
    - a. Ladder wiring diagram.
    - b. Pneumatic schematic diagrams.
    - c. One line system diagram.
    - d. Control schematic of equipment with control devices located and identified.
    - e. Wiring or tubing termination diagrams.
    - f. List of materials.
    - g. Floor plan indicating all device locations.
    - h. Control sequences.
    - i. Indicate electrical power source for each point of connection to the electrical system.
  - 2. Reproducible temperature control drawings shall be delivered to the Architect/Engineer prior to Owner's acceptance of project.

## 1.9 OPERATING AND MAINTENANCE DATA

- A. Refer to Division 1 for additional requirements.
- B. Submission:
  - 1. Submit typed and bound copies of Operating and Maintenance Manuals prior to scheduling systems demonstration for the Owner, as specified in Division 1.
  - 2. Bind each Maintenance Manual in one or more vinyl covered, 3-ring binders, with pockets for folded drawings.
    - a. Mark the back spine of each binder with system identification and volume number.
- C. Required Contents:
  - 1. Manuals shall have index with tab dividers for each major equipment section to facilitate locating information on specific piece of equipment.
  - 2. Identify data within each section with drawing code numbers as they appear on Drawings and Specifications. Include as a minimum the following data:
    - a. Alphabetical list of system components, with the name, address and 24 hour telephone number of the company responsible for servicing each item during the first year of operation. Include point of contact for company.
    - b. Operating instructions for complete system including:
      - 1) Emergency procedures for fire and failure of major equipment.
      - 2) Major start, operation and shut-down procedures.
    - c. Maintenance Instructions for each piece of equipment including:
      - 1) Equipment lists.
      - Proper lubricants and lubricating instructions for each piece of equipment.
      - 3) Necessary cleaning, replacement and/or adjustment schedule.
      - 4) Product Data.
      - 5) Installation instructions.

- 6) Parts lists.
- 7) Complete wiring diagrams.
- d. Temperature control diagrams and O&M information as specified above (asbuilt).
- e. Marked or changed prints locating concealed parts and variations from the original system design (as-built drawings).
- f. Balancing Report.
- g. Valve schedule and associated piping schematics. See Division
- 23 05 53, Mechanical Identification.
- h. Copies of any extended equipment warranties, which are greater than one year.

## 1.10 WARRANTIES

- A. The warranty period is one year after Date of Acceptance.
  - During this period, provide labor and materials as required to repair or replace defects in the mechanical system at no additional cost to the Owner. Provide certificate with O&M manual submittal which guarantees same-day service response to Owners call for all such warranty service.
  - 2. Provide certificates for such items of equipment which have warranties in excess of one year. Insert copies in O&M manuals. Such equipment shall include:
    - a. Temperature Control Valves five (5) years.
    - b. Compressors five (5) years.
  - 3. Provide extended manufacturers warranties to cover one full year from date of acceptance if standard warranty starts any time prior to that date.
  - 4. Provide factory trained service personnel for all warranty work on the DDC Control System and the VRF System.
- B. Refer to Division 1 for additional requirements.

# 1.11 SCOPE

- A. The Contractor shall:
  - 1. Supply all labor, transportation, materials, apparatus, light, and tools necessary for the completion of the mechanical work.
  - 2. Install, maintain, and remove all construction equipment.
  - 3. Be responsible for safe, lawful, and proper construction maintenance.
  - 4. Construct, in the best and most workmanlike manner, a complete project and everything properly incidental thereto, as shown on the Drawings, as stated in the Specifications, or reasonably implied therefrom, all in accordance with the Contract documents.

# 1.12 MANDATORY GOVERNING PROVISION

- A. Omissions of words or phrases, such as "the Contractor shall," "in conformity with," "shall be," "as noted on the Drawings," "according to the Drawings," "an," "the," and "all," are intentional.
- B. Omitted words or phrases shall be supplied by inference.

## 1.13 PROTECTION OF PROPERTY AND MATERIALS

- A. Provide protection against dust migration, rain, wind, storms, frost, or heat, so as to maintain all work, materials, apparatus, and fixtures free from injury or damage.
- B. At end of each day's work, cover all new work likely to be damaged.
- C. Do not interrupt the integrity of the building security overnight.

D. Refer to Division 1 for additional requirements.

#### 1.14 OWNER FURNISHED EQUIPMENT

A. All equipment called out in the Specifications or shown on the Drawings as "Owner-Furnished Equipment" shall be installed and connected under this Contract. Provide rough-ins for all future connections indicated.

## 1.15 TEMPORARY FACILITIES

- A. Light, Heat, Power, etc.
  - 1. Responsibility for providing temporary electricity, heat and other facilities shall be as specified in Division 1.
  - 2. Contractor shall be responsible for maintaining the equipment in an as-new condition. Equipment will not be turned over to the Owner until it is brought up to as-new condition.
  - 3. The contractor shall be responsible for maintaining acceptable indoor air quality in adjacent occupied spaces.
- B. Use of Permanent Building Equipment for Temporary Heating or Cooling.
  - 1. Permanent building equipment shall not be used without written permission from the Owner. If this equipment is used for temporary heating or cooling, it shall be adequately maintained per manufacturer's instructions and protected with filters, strainers, controls, reliefs, etc. The contractor shall protect all equipment and systems as directed by the engineer. The warranty period shall not start until the equipment is turned over to the Owner for his use. The contractor shall provide extended warranties for parts and labor for all such equipment. Equipment shall not be turned over to the Owner until the temperature controls have been tested and accepted by the Owner and Engineer.

## 1.16 INSTALLATION GENERAL REQUIREMENTS

- A. Furnish, apply, install, connect, erect, clean, and condition manufactured materials and equipment as recommended in manufacturer's printed directions (maintained on job site during installation).
- B. Provide all attachment devices and materials necessary to secure materials together or to other materials.
- C. Make allowance for ample and normal expansion and contraction for all building components and piping systems that are subject to such.
- D. Install materials only when conditions of temperature, moisture, humidity, and conditions of adjacent building components are conducive to achieving the best installation results.
- E. Erect, install, and secure components in a structurally sound and appropriate manner.
- F. Where necessary, temporarily brace, shore, or otherwise support members until final connections are installed.
- G. Leave all temporary bracing, shoring, or other structural supports in place as long as practical for safety and to maintain proper alignment.
- H. Handle materials in a manner to prevent scratching, abrading, distortion, chipping, breaking, or other disfigurement.
- I. Conduct work in a manner to avoid injury or damage to previously placed work.
- J. Any work so impaired or damaged shall be replaced at no expense to Owner.
- K. Fabricate and install materials true to line, plumb, and level.
- L. Leave finished surfaces smooth and flat, free from wrinkles, warps, scratches, dents, and other imperfections.

- M. Furnish materials in longest practical lengths and largest practical sizes to avoid all unnecessary jointing.
- N. Make all joints secure, tightly fitted, and as inconspicuous as possible by the best accepted practice in joinery and fabrication.
- O. Consult Engineer for mounting height or position of any unit not specifically indicated or located on Drawings or specified in Specifications.
- P. Job mixed multi-component materials used in the work shall be mixed in such regulated and properly sized batches that material can be used before it begins to "set".
- Q. Mixing of a partially "set" batch with another batch of fresh materials will not be accepted and entire batch shall be discarded and removed from site.
- R. Clean all mixing tools and appliances that can be contaminated prior to mixing of fresh materials.
- S. In addition to the above refer to each Section of the Specifications for additional installation requirements for the proper completion of all work.

# PART 2 – PRODUCTS

## 2.1 QUALITY CONTROL

- A. Refer to Division 1 of the Specifications.
  - 1. The manufacturer of equipment or materials listed on the drawings or first named in the specification is the basis of design. If the drawings and specifications are in conflict, the drawings shall take precedence. Other manufacturers listed are considered general equivalents only. See below for coordination of substitutions.
- B. Products by manufacturers not listed in this Specification may be submitted to Architect/Engineer during Bidding Period in accordance with Division 1.
- C. Any manufacturer not listed shall be considered a substitution.
- D. Items submitted as a substitution to the basis of design or listed general equivalents shall be identified as such and shall include a written request for substitution indicating the following:
  - 1. Contract price adjustment.
  - 2. Contract time adjustment.
  - 3. Item by item breakdown of differences between basis of design and substituted item.
  - 4. Operation, maintenance, and energy cost difference.
- E. Coordination of general equivalents and substitutions: Where Contract Documents permit selection from several general equivalents, or where substitutions are authorized, coordinate clearance and other interface requirements with mechanical and other work.
  - 1. Provide necessary additional items so that selected or substituted item operates equivalent to the basis of design and properly fits in the available space allocated for the basis of design.
  - 2. Provide all features which are standard on the basis of design.
  - 3. Contractor is responsible for assuring that piping, conduit, duct, flue, and other service locations for general equivalents or substitutions do not cause access, service, or operational difficulties any greater than would be encountered with the basis of design.

# 2.2 GENERAL SUBMITTAL REQUIREMENTS

- A. Refer to Division 1.
- B. Coordination and Sequencing:
  - 1. Coordinate submittals 2 weeks (min.) prior to expected order date so that work will not be delayed by submittals.

- 2. No extension of time will be allowed because of failure to properly coordinate and sequence submittals.
- 3. Do not submit product data, or allow its use on the project until compliance with requirement of Contract Documents has been confirmed by Contractor.
- 4. Submittal is for information and record, unless otherwise indicated, and is not a change order request.
- 5. Submitting contractor is responsible for routing reviewed submittals to all parties affected including but not limited to electrical, temperature control, and test and balance subcontractors.
- C. Preparation of Submittals:
  - 1. Refer to Division 1 requirements.
  - 2. Provide permanent marking on each submittal to identify project, date, Contractor, Subcontractor, Supplier, submittal name and similar information to distinguish it from other submittals.
  - 3. Indicate any portions of work which deviate from the Contract Documents.
    - a. Explain the reasons for the deviations.
    - b. Show how such deviations coordinate with interfacing portions of other work.
  - 4. Show Contractor's executed review and approval marking.
  - 5. Provide space for Architect's/Engineer's "Action" marking.
  - 6. Submittals which are received from sources other than through Contractor's office will be returned "Without Action".
  - 7. Submittals shall be presented in a neat and legible fashion and shall be returned "Without Action" if presented in any other fashion.
- D. Quantities: Unless otherwise indicated in Division 1, submit six copies.
  - 1. Refer to Division 1 requirements.
  - 2. Multiple System Items: Where a required submittal relates to an operation or item of equipment used in more than one system, increase the number of final copies as necessary to complete the Maintenance Manuals for each system.
  - 3. Preliminary Submittal: Provide a preliminary, two-copy submittal for automatic temperature controls and when product data is required (or desired by Contractor) for selection of options by Architect/Engineer.
  - 4. General Distribution:
    - a. Provide additional distribution of submittals (not included in foregoing copy submittal requirements) to Subcontractors, Suppliers, Fabricators, Installers, Governing Authorities and others as necessary for proper performance of the work.
    - b. Include such additional copies in transmittal to Architect/Engineer where required to receive "Action" marking before final distribution.
      - 1) Show such distributions on transmittal forms.
- E. Response to Submittals: Where standard product data have been submitted, it is recognized:
  - 1. That the Submitter has determined that the products fulfill the specified requirements.
  - 2. That the submittal is for the Architect's or Engineer's information only, but will be returned with appropriate action where observed to be not in compliance with the requirements.
- F. If more than two submissions (either for shop drawings, as-built drawings, or test and balance reports) are made by the contractor, the Owner reserves the right to charge the contractor for subsequent reviews by their consultants. Such extra fees shall be deducted from payments by the Owner to the contractor.

# 2.3 SPECIFIC CATEGORY SUBMITTAL REQUIREMENTS

- A. Manufacturer's Data:
  - 1. Where pre-printed data covers more than one distinct product, size, type, material, trim, accessory group or other variation, mark submitted copy with black pen to indicate which of the variations is to be provided.
  - 2. Delete or mark-out significant portions of pre-printed data which are not applicable.
  - 3. Where operating ranges are shown, mark data to show portion of range required for project application.
  - 4. For each product, include the following:
    - a. Sizes
    - b. Weights
    - c. Speeds
    - d. Capacities
    - e. Piping and electrical connection sizes and locations.
    - f. Statements of compliance with the required standards and regulations.
    - g. Performance data.
    - h. Manufacturer's specifications and installation instructions.
- B. Shop Drawings:
  - 1. Prepare Mechanical Shop Drawings, except diagrams, to accurate scale.
    - a. Show clearance dimensions at critical locations.
    - b. Show dimensions of spaces required for operation and maintenance.
    - c. Show interfaces with other work, including structural support.
- C. Test Reports:
  - 1. Submit test reports which have been signed and dated by the firm performing the test.
  - 2. Prepare test reports in the manner specified in the standard or regulation governing the test procedure (if any) as indicated.
- D. Required equipment and shop drawing submittals:
  - 1. Provide a submittal schedule with bid.
  - 2. Provide equipment submittals for each item of equipment specified or scheduled in the contract documents.
  - 3. Submittal Schedule shall show each item of equipment, applicable Section of the specifications where it is described, applicable Drawing number and schedule name where it is scheduled, date of Contractor's proposed submittal to Architect, required date to receive submittal from Architect and schedule order date.
  - 4. Provide a Mechanical Shop Drawing Schedule for submission to the Architect with the Submittal Schedule. Refer to paragraph 1.3 -Coordination Within Divisions 22 through 23 above.

# 2.4 COMPATIBILITY

- A. General: Provide products which are compatible with other products of the mechanical work, and with other work requiring interface with the mechanical work.
- B. Altitude Ratings: Except where noted otherwise, all ratings and capacities stated in the Contract Documents are at the altitude of the project, not sea level. Project Altitude shall be considered to be 5400 feet.
- C. Fuel Characteristics:
  - 1. Review fuel characteristics with the Fuel Supplier designated by the Owner.
  - 2. Determine burner or combustion equipment provisions needed for optimum performance. Provide equipment accordingly.

# D. Power Characteristics:

- 1. For power characteristics of equipment supplied under Division 22 through 23 Sections, refer to the Sections of Divisions 26 through 28 and the Electrical Drawings for the power characteristics of each power driven item of mechanical equipment.
- Coordinate available power with Electrical Contractor before ordering equipment. Mechanical Contractor shall be responsible for ordering equipment to meet the available power characteristics.
- 3. See also Division 23 05 01 of these specifications.
- 4. If there is a conflict between Divisions 22 through 23 documents and Divisions 26 through 28 documents, alert the engineer. Do not order equipment prior to determining the proper electrical service. No contract cost adjustment will be allowed for equipment ordered in conflict with the available power characteristics.

# 2.5 SAFETY PROVISIONS

- A. Equipment Nameplates: Provide power-operated mechanical equipment with a permanent nameplate attached by the manufacturer, indicating:
  - 1. The manufacturer
  - 2. Product name
  - 3. Model number
  - 4. Serial number
  - 5. Speed
  - 6. Capacity
  - 7. Power characteristics
  - 8. Labels of testing, listing, or inspecting agencies
  - 9. Other similar data
- B. Where manufacturer affixed nameplate is not available, Mechanical Contractor shall fabricate and attach nameplate.
- C. Guards:
  - 1. Unless equivalent guards are provided integral with the equipment, enclose each belt drive (including sheaves) on both side in a galvanized, one inch, mesh screen of No. 18 gauge steel wire or expanded metal, fastened to an approved, structural steel frame, securely fastened to the equipment or floor.
  - 2. Provide tachometer holes at shaft centers. Unless equivalent guards are provided integral with the equipment, install a solid guard of No. 20 gauge galvanized steel over the coupling of each item of direct-driven equipment.
  - 3. Sides are not required on these guards except to ensure rigidity.

# 2.6 SAFETY PROVISIONS

- A. Any refrigeration system containing CFC-11, CFC-12, HCFC-123, HCFC-22, or any of the other refrigerants listed in the Clean Air Act as a Class I or Class II Ozone Depleting Compound shall comply with the Clean Air Act and the Colorado Air Quality Control Commission Regulation #15.
- B. As a minimum all systems shall be equipped with refrigerant recovery service valves, relief valves capable of resetting after activation, and for system with more than 50 pounds of charge, and isolateable receiver and/or condenser capable of holding the complete charge.

# PART 3 - EXECUTION

# 3.1 COORDINATION OF MECHANICAL INSTALLATION

- A. Inspection and Preparation:
  - 1. Examine the work interfacing with mechanical work, and the conditions under which the work will be performed, and notify the Architect/Engineer of conditions detrimental to the proper completion of the work at original contract price.
  - 2. Do not proceed with the work until unsatisfactory conditions have been corrected.
- B. Layout:
  - 1. Layout the mechanical work in conformity with the Contract Drawings, Coordination Drawings and other Shop Drawings, product data and similar requirements so that the entire mechanical plant will perform as an integrated system, properly interfaced with other work, recognizing that portions of the work are shown only in diagrammatic form.
  - 2. Where coordination requirements conflict with individual system requirements, comply with the Architect's or Engineer's decision on resolution of the conflict.
  - 3. Take necessary field measurements to determine space and connection requirements.
  - 4. Provide sizes and shapes of equipment so the final installation conforms to the intent of the Contract Documents.
- C. Integrate mechanical work in ceiling spaces with suspension system, light fixtures and other work so that required performances of each will be achieved.

# 3.2 PRODUCT INSTALLATION

- A. Manufacturer's Instructions:
  - 1. Except where more stringent requirements are indicated, comply with the product manufacturer's instructions and recommendations.
  - 2. Consult with manufacturer's technical representatives, who are recognized as technical experts, for specific instructions on special project conditions.
  - 3. If a conflict exists, notify the Architect/Engineer in writing and obtain his instruction before proceeding with the work in question.
- B. Movement of Equipment:
  - 1. Wherever possible, arrange for the movement and positioning of equipment so that enclosing partitions, walls and roofs will not be delayed or need to be removed.
  - 2. Otherwise, advise Contractor of opening requirements to be maintained for the subsequent entry of equipment.
- C. Heavy Equipment:
  - 1. Coordinate the movement of heavy items with shoring and bracing so that the building structure will not be overloaded during the movement and installation.
  - 2. Where mechanical products to be installed on the existing roof are too heavy to be handcarried, do not transport across the existing roof deck; position by crane or other device so as to avoid overloading the roof deck.
- D. Return Air Path: Coordinate mechanical work in return air plenum to avoid obstructing return air path.
  - Do not make changes in layout which will reduce return air path cross-sectional areas. Minimum cross-sectional area will provide an average of 500 fpm and a maximum of 750 fpm velocity through return air plenum at specified supply air quantity unless otherwise noted.
  - Provide openings in any full height walls to allow for free movement of return air. Openings are to be sized for 500-750 fpm velocity. Notify the Architect/Engineer for any openings required in fire rated walls that are not shown on the contract drawings.
  - 3. Report any obstructions by work of other Divisions to Architect/Engineer.

# E. Clearances:

- 1. Install piping and ductwork:
  - a. Straight and true.
  - b. Aligned with other work.
  - c. Close to walls and overhead structure (allowing for insulation).
  - d. Concealed, where possible, in occupied spaces.
  - e. Out-of-the-way with maximum passageway and headroom remaining in each space.
- 2. Except as otherwise indicated, arrange mechanical services and overhead equipment with a minimum of:
  - a. 7'0" headroom in storage spaces.
  - b. 8'6" headroom in other spaces; where approved by Architect.
- 3. Do not obstruct windows, doors or other openings.
- 4. Give the right-of-way to piping systems required to slope for drainage (over other service lines and ductwork).
- F. Access:
  - 1. Provide for removal, without damage to other parts, of:
    - a. Coils
    - b. Tubes
    - c. Shafts
    - d. Fan wheels
    - e. Drives
    - f. Filters
    - g. Strainers
    - h. Bearings
    - i. Control components
    - j. Other parts requiring periodic replacement or maintenance
  - 2. Connect equipment for ease of disconnecting with minimum of interference with other work.
  - 3. Provide unions where required.
  - 4. Locate operating and control equipment and devices for each access.
  - 5. Provide access panels where units are concealed by non-accessible finishes and similar work. See Section 23 05 03.
  - 6. Extend all grease fittings to an accessible location.

#### 3.3 PROTECTION OF WORK

- A. All pipe ends, valves, ducts, and equipment left unconnected shall be capped, plugged or otherwise properly protected to prevent damage or the intrusion of foreign matter.
- B. Do not allow any fans in the HVAC system to operate before the area served by the fan has been cleaned and vacuumed of all debris and dust which might enter the system.
- C. Any equipment, duct or piping systems found to have been damaged or contaminated above "MILL" or "SHOP" conditions shall be replaced or cleaned to the Engineer's satisfaction.
- D. Initial fill of traps:
  - 1. Provide initial water seal fill for all waste P-traps, condensate traps, or similar traps.

#### 3.4 PROTECTION OF POTABLE WATER SYSTEMS

A. All temporary water connections shall be made with an approved back flow preventer.

- B. All hose bibs shall have as a minimum, a vacuum breaker, to prevent back flow.
- C. Direct connections to hydronic systems shall only be made through a reduced pressure back flow preventer.

## 3.5 PROTECTION OF SYSTEMS SERVING OCCUPIED SPACES

- A. Where work is being performed in occupied spaces, or occupancy is to be phased in with ongoing construction, contractor shall prevent contamination of all systems serving the occupants including but not limited to:
  - 1. Supply Or Return Air
    - a. Systems shall be capped or provided with adequate particulate and gas phase filtration to prevent dust, chemical, or biological contamination. Particulate filters shall be as a minimum equivalent to those specified for the completed system.
  - 2. Domestic Water
    - a. Isolate sterilized portions from non-sterilized portions.

## 3.6 DEMONSTRATION

- A. Refer to Division 1 sections of the specifications regarding requirements of Record Drawings and Operation and Maintenance Manual submittal and systems demonstration.
  - 1. Demonstrate to the Architect/Engineer that each system operates in accordance with the contract documents.
  - 2. Explain the operation of each system to the Owner's Representative. Explain use of O&M manual in operating and maintaining systems.
- B. Date and time of demonstration will be determined by Owner.

## 3.7 PROJECT CLOSEOUT

- A. Refer to the individual sections of the specifications for individual closeout requirements.
- B. Provide a written schedule of when systems are to be started up, tested and demonstrated along with dates for completion of the temperature controls and balancing. This schedule shall be submitted no later than 30 days prior to starting up and testing equipment.
- C. The contractor shall notify the Architect/Engineer no later than 2 weeks in advance of system testing or demonstration.

#### END OF SECTION 230502

# SECTION 230503 - BASIC MECHANICAL MATERIALS AND METHODS

# PART 1 – GENERAL

## 1.1 RELATED DOCUMENTS

- A. This Section supplements Division 1, General Requirements.
- B. Where contradictions occur between this Section and Division 1, the most stringent of the two shall apply. The Architect design team shall decide which is most stringent.
- C. Provisions of this Section shall also apply to all Sections of Divisions 22 through 23.

## 1.2 SUBMITTALS

- A. Manufacturer's Data Submit manufacturer's data for:
  - 1. Access panels.
  - 2. Fire stopping materials.
  - 3. Heat Trace.
- B. Application Data Submit application data for firestopping materials showing UL required installation details for every combination of pipe material, penetrated structure, opening size and required fire rating within the scope of this project. Application data drawings shall include UL system number.

# PART 2 – PRODUCTS

## 2.1 ACCESS PANELS

- A. See Division 8 for access panel types and finishes.
  - 1. If panels are not specified in Division 8, comply with the following:
    - a. Manufacturers:
      - 1) Design Basis: Milcor Division, Inryco, Inc.
      - 2) Other Acceptable Manufacturers:
        - a) Birmingham Ornamental Iron Co.
        - b) Karp Associates, Inc.
        - c) Wilkenson Co., Inc.
        - d) Zurn.
- B. Construction:
  - 1. Doors: 14 gauge steel.
  - 2. Frames: 16 gauge steel.
  - 3. Fire Rating: Equivalent to construction in which installed.
  - 4. Latches: Flush or concealed, ¼ turn.
  - 5. Finish: Compatible with finish of construction in which installed.

# 2.2 FIRE STOPPING MATERIAL

- A. Manufacturers:
  - 1. Design Basis: 3M.
  - 2. Other acceptable manufacturers:

a. GE

- b. Metalines
- c. Hilti

# B. General Requirements:

- 1. Products to be used shall have been tested in accordance with ASTM E 814-88, and be listed in the UL Fire Resistance Directory.
- C. Bare Piping:
  - 1. Model: FD 150, or CP-25.
- D. Insulated Piping:
  - 1. Model: CP-25 or FS-195, Intumescent.
  - 2. "No-sag" or "self-leveling" as required.
- E. Plastic Piping:
  - 1. Model: CP-25 or FS-195, Intumescent.
  - 2. "No sag" or "self-leveling" as required.
- F. Accessories:
  - 1. Provide fasteners, restricting collars, backing materials, and protective coatings as required to comply with the UL system listing.

## 2.3 HEAT TRACE

- A. Manufacturers:
  - 1. Design Basis: Raychem.
    - a. Model: XL-Trace for freeze protection applied between pipe and insulation.
    - b. Model: Ice stop for freeze protection applied inside storm drain leaders and down spouts.
  - 2. Other acceptable manufacturers:
    - a. Thermon
    - b. Hevi-Duty/Nelson
- B. Features:
  - 1. Self regulating at all points along its length.
  - 2. 90% power reduction from 40°F pipe temperature to 150° pipe temperature.
  - 3. No overheating if crossed.
  - 4. Provide outer jacket and braided copper shield for use inside roof drain leaders or on piping without a ground path.
- C. Accessories:
  - 1. Provide tee, splice, and end seal kits as required by the manufacturer.
  - 2. Provide ambient sensing thermostat in a NEMA 4x enclosure, with three (3) contacts rated at 22 amps each.
- PART 3 EXECUTION

# 3.1 EXCAVATION

A. Quality Coordination: Where excavation and backfill for mechanical work passes through or occurs in the same area as work specified in Division 2, comply with both the requirements of Division 2 and the requirements of this Section, or whichever is the more stringent (as determined by the Architect/Engineer in cases of conflicting requirements).

- B. Inspection:
  - 1. Examine the areas to be excavated, and the conditions under which the work is to be performed.
  - 2. Notify the Architect/Engineer in writing of conditions detrimental to the proper completion of the work.
  - 3. Do not proceed with excavating until unsatisfactory conditions have been corrected.
- C. General:
  - 1. Do not excavate for mechanical work until the work is ready to proceed without delay, so that the total time lapse from excavation to completion of backfilling will be minimum.
  - 2. Remove all rock and boulders from excavation before installing mechanical work.
  - 3. Slope sides of excavations as required for stability, or provide necessary shoring.
  - 4. Remove shoring during backfilling.
  - 5. Excavate near large trees (within the drip line) by hand.
    - a. Protect the root system from damage or drying to the greatest extent possible.
    - b. Maintain moist condition for root system and cover exposed roots with burlap.
    - c. Paint root cuts of 1" diameter and larger with asphaltic tree paint.
  - 6. Saw-cut asphalt and concrete surfaces.
- D. Existing Utilities: Locate and protect existing utilities and other underground work in a manner which will ensure that no damage or service interruption will result from excavating and backfilling.
- E. Depth of Excavation:
  - 1. Depth for Exterior Piping: Except as otherwise indicated, excavate for exterior piping so that the vertical distance between top of piping and finished grade will not be less than that prescribed by code.
  - Excavate for exterior water-bearing piping (water, steam condensate, drainage) so that the vertical distance between top of piping and finished grade will not be less than 5'0" [Verify for actual job location. Normally use frost depth plus 2 feet] vertical distance below finished grade.
  - 3. Depth for Unsatisfactory Soil Conditions:
    - a. Where directed, because of unsatisfactory soil condition at bottom of excavation, excavate additional depth as directed to reach satisfactory soil-bearing condition. Backfill with "squeegee" washed rock, or other approved sub-base material, compacted as directed, to indicated excavation depth.
    - b. Where piping crosses over an area more than 5'0" wide, which has been previously excavated to a greater depth than required for the piping installation:
      - Excavate to undisturbed soil in a width equal to the pipe diameter plus 2'0".
      - Install "squeege" washed rock, or 8" courses of approved subbase material; each course compacted to 95% of maximum density, as required to fill excavation and support piping.
    - c. Refer to Change Order procedure elsewhere in Contract Documents.
- F. Protection:
  - 1. Provide temporary covering or enclosure and temporary heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install mechanical work on frozen excavation bases or subbases.
  - 2. Coordinate excavations with weather conditions, to minimize the possibility of washouts, settlements and other damages and hazards.
  - 3. Allow no more than 100 feet between pipe laying and point of complete backfilling.
  - 4. Maintain dry excavations for mechanical work by removing water.
    - a. Protect excavations from inflow of surface water.
    - b. Pump minor inflow of ground water from excavations.

- c. Protect excavations from major inflow of ground water by installing temporary sheeting and waterproofing.
- d. Provide adequate barriers which will protect other excavations and below-grade property from being damaged by water, sediment or erosion from or through mechanical work excavations.
- 5. Provide signs, illumination and barricades as necessary to prevent accidents at excavations.
- 6. Install and operate a well-point dewatering system to maintain ground water at a level approximately 2'0" below mechanical work excavations, until backfilling is completed.
- G. Excavated Material:
  - 1. Store excavated material (temporarily) near the excavation, in a manner which will not interfere with or damage the excavation or other work. Do not store under trees (within the drip line).
  - 2. Retain excavated material which complies with the requirements for backfill material.
  - 3. Remove excavated material which is either in excess of quantity needed for backfilling or does not comply with requirements for backfill material from project site, and dispose of in a lawful manner.
  - 4. Coordinate acceptable stockpiling areas with Owner in advance of excavation.
- H. Bedding:
  - 1. Where indicated below, install as bedding material graded sand with 100% passing through a 3/8" sieve, and 0% passing through No. 100 sieve.
    - a. Compact by tamping to form a firm base for the work.
    - b. Install bedding from six inches below bottom of pipe to six inches above top of pipe.
    - c. Provide bedding for:
      - 1) Wrapped, coated or plastic pipe and tanks.
      - 2) Piping over six inches, horizontal cylindrical tanks, and similar work.
        - a) Shape the subbase to fit the shape of the bottom 90° of the cylinder, for uniform continuous support.
      - 3) All water and sewer pipe.
  - 2. Where rock is used as sub-base, place 8-mil polyethylene between rock and bedding.
  - 3. Shape sub-bases and bottoms of excavations with recesses to receive pipe bells, flange connection, valves and similar enlargements in the piping systems.
- I. Concrete Encasement: Where piping under roadways is less than 2'6" below surface of roadway, or where ductwork is buried below grade:
  - 1. Provide 4" base slab of concrete to support piping and ductwork.
  - 2. After piping or ductwork is installed and tested, provide 4" thick encasement (sides and top) of concrete before backfilling.
    - a. Provide external structural reinforcing of all rectilinear cross section ductwork or any ductwork which is less than 18 ga sheet metal (or equivalent) to prevent collapse of ductwork encasement.
  - 3. Provide minimum 2500 psi concrete for encasement and slab.
- J. Backfilling:
  - 1. Do not backfill until installed mechanical work has been tested and accepted, wherever testing is indicated.
  - 2. Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to the required densities.
  - 3. Do not backfill with frozen soil materials.

- 4. Backfill simultaneously on opposite sides of mechanical work, and compact simultaneously.
- 5. Do not dislocate the work from installed positions.
- 6. Backfill to elevations matching adjacent grades, at the time of backfilling excavations for mechanical work.
- 7. Backfill with finely graded sub-base material to 6" above wrapped, coated, and plastic piping and tanks, and to centerline of other tanks.
- Backfill excavations in 8" high courses of backfill material, uniformly compacted to the densities indicated in Division 2 using power-driven, hand-operated compaction equipment.
- 9. If densities are not indicated in Division 2, compact to the following percent of maximum per ASTM D1557:
  - a. Lawn/Landscaped Areas: 85%.
  - b. Paved Areas, Other than Roadways: 90%.
  - c. Roadways: 95%.
  - d. Floors: 95%.
- 10. Where compaction tests indicate lower densities of backfill than specified, continue compaction (and re-excavation and backfilling where necessary).
  - a. Provide additional testing as directed by the Architect/Engineer.
  - b. The allowable density tolerance is not more than one-test-out-of-five failing more than two percentage points below the specified density.
  - c. Initial testing is not work of this Section.
- 11. Where subsidence is measurable or observable at mechanical work excavations during the guarantee period:
  - a. Remove the surface (pavement, lawn or other finish).
  - b. Add backfill material, compact, and replace the surface treatment.
  - c. Restore the appearance, quality and condition of the surface or finish to match adjacent work.
  - d. Eliminate evidence of the restoration to the greatest extent possible.
- K. Landscape Restoration:
  - 1. Where excavation and backfill for mechanical work passes through or occurs in a landscaped area, repair or replace the landscape work to match the original condition and quality of the work.
  - 2. Comply with the requirements of Division 2 for repair or replacement of work, and for follow-up maintenance on lawns and planting to ensure satisfactory recovery.
- L. Pavement Restoration:
  - 1. Where excavation and backfill for mechanical work passes through or occurs in an area of paving or flooring, replace and restore the construction and finish of the paving or flooring to match the original condition and quality of the work.
- M. Surface Repairs:
  - 1. The repairing and replacing of previously installed landscape development work, paving, floor slabs and similar finishes occurring in excavated areas shall be provided, but is not included in work of Divisions 22 through 23.

# 3.2 CUTTING AND PATCHING

- A. Refer to Division 1 of the Specifications.
- B. General:

Provide measurements, drawings and layouts to installers of other work so that required openings may be provided as construction progresses. Any cutting and patching made necessary by failure to provide this information shall be done at no increase in the contract amount.

C. General:

All cutting and patching of existing work required for work of Divisions 22 through 23 is included in Divisions 22 through 23.

- D. Where possible, mark openings to be cut on existing construction. Otherwise, provide measurements, drawings and layouts to the trade doing the cutting so that openings may be provided as construction progresses.
- E. Cutting Concrete:
  - 1. Where authorized, cut openings through concrete for pipe penetration and similar services by core drilling or sawing.
  - 2. Do not cut by hammer-driven chisel or drill.
- F. Cutting:
  - 1. Cut openings in accordance with layouts, measurements or drawings of the Installer of work requiring openings. Cut openings in concrete by core drilling or sawing; not by hammer-driven chisel or drill.
  - 2. Coordinate the location of all openings with structural drawings. Report any discrepancies to Architect. Do not proceed with work until discrepancies have been resolved.
  - 3. Do not endanger or damage other work through the procedures and processes of cutting to accommodate mechanical work.
  - 4. Review the proposed cutting with the Installer of the work to be cut, and comply with his recommendations to minimize damage.
  - 5. Where necessary, engage the original Installer or other specialists to execute the cutting in the recommended manner.
- G. Patching:
  - 1. Where patching is required to restore other work because of either cutting or other damage inflicted during the installation of mechanical work, engage experienced craftsmen to complete the patching of the other work.
  - 2. Restore the other work in every respect, including the elimination of visual defects in exposed finishes.
  - 3. All openings in fire rated construction shall be patched and sealed with U.L. approved sealant to maintain the fire integrity of the structure.
- H. Perform cutting, and patching required to:
  - 1. Uncover work to provide installation of ill-timed work.
  - 2. Remove and replace defective work.
  - 3. Remove and replace work not conforming to requirements of the Contract Documents.
  - 4. Remove samples of installed work as specified for testing.
  - 5. Install equipment and materials in existing structures.
  - 6. Upon written instructions from the Architect/Engineer, uncover and restore work to provide for Architect/Engineers observation of concealed work.
- I. Painting:

Paint all surfaces marred by cutting and/or patching to match existing.

- 1. Engage experienced painters.
- 2. Comply with requirements of Painting Sections of this Specification.
- J. Structural Limitations:
  - 1. Do not cut or drill into structural framing, walls, floors, decks, and other members intended to withstand stress, except with Engineer's written authorization.
    - a. Provide lintels, columns, braces and other temporary and permanent supports made by cutting.
    - b. Submit shop drawings of permanent supports.

c. Do not penetrate legs of structural "T's" or any other location where pre-stressed structural chords are likely to be encountered when cutting or drilling.

# 3.3 ACCESS PANELS

- A. Furnish access panels where indicated and at locations where required for access to:
  - 1. Concealed valves
  - 2. Dampers
  - 3. Control devices
  - 4. Equipment servicing
  - 5. Shock arresters
  - 6. Air vents
  - 7. Flow measuring and balancing stations
  - 8. Any other device or item equipment requiring maintenance, adjustment or service.
- B. Deliver access panels for installation by the trade responsible for surface in which installed.
  - 1. Provide instructions for location.
  - 2. The minimum size for access doors shall be the larger of 24"x24" or to fit the size of equipment to be removed.

# 3.4 SLEEVES

- A. Provide sleeves for piping passing through walls, floors and roofs.
- B. Set pipe sleeves and inserts in place before concrete is poured. Coordinate the placing of these items to avoid delaying concrete placing operations.
- C. Locate chases, shafts, and openings required for the installation of the mechanical work during framing of the structure. Do any additional cutting and boring required due to improperly located or omitted openings without cost to the Owner under the supervision of the Owner's representative.
- D. Size sleeves for below grade pipe a minimum of 2" beyond outside of pipe.
- E. Coat surface of all sleeves in contact with concrete, masonry or soil with two coats of coal tar bitumastic paint.
- F. Provide Sleeves as Follows:

| Sleeve Location                                                             | Sleeve Material                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Interior Stud Partition Walls                                               | Adjustable galvanized sheet metal with wall flanges and plaster lip, 2" and smaller – 22 gauge, 3" through 6" – 20 gauge, 8" and larger – 18 gauge.                                                                                                                                                                                                                                                                                               |
| Membrane Waterproof Floor and Roof<br>Construction                          | Galvanized cast iron body with flashing clamp, threaded for sleeve riser. (J.R. Smith 1760 or equivalent by Ancon, Zurn or Josam).                                                                                                                                                                                                                                                                                                                |
| Nonmembrane Floor, Construction                                             | Non-adjustable galvanized sheet metal with deck flange and end cap, 2" and smaller – 22 gauge, 3" – 20 gauge, 4" and larger – 16 gauge.                                                                                                                                                                                                                                                                                                           |
| Exterior Walls Below Grade                                                  | Standard weight galvanized steel pipe with a continuously<br>welded water stop of ¼" steel plate extending from outside of<br>sleeve a minimum of 2" all around. Provide modular<br>mechanical-type seal consisting of interlocking synthetic rubber<br>links with bolts shaped to continuously fill the annular space<br>between the pipe and sleeve. Thunderline Corporation "Link-<br>Seal" sealant assembly or equal by Metraflex "MetaSeal". |
| Floors of Mechanical Rooms, Concrete<br>Walls or Masonry Walls Above Grade. | Standard weight galvanized steel pipe.                                                                                                                                                                                                                                                                                                                                                                                                            |

G. Length of Sleeves as Follows:

| Location | Sleeve Length                                                                                                                                                                     |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Floors   | Equal to depth of floor construction including finish. Extend<br>minimum of 1" above finished floor level within partitions,<br>mechanical rooms, pipe chases and finished areas. |
| Roofs    | Equal to depth of roof construction including insulation.                                                                                                                         |
| Walls    | Equal to depth of construction.                                                                                                                                                   |

## 3.5 FIRE STOPPING

- A. Install firestopping materials in accordance with their UL and ASTM tested methods.
- B. Coordinate required annular space with size of pipe and sleeve. Refer to Section 23 05 22.
- C. Requirements for specific systems:
  - 1. Cold piping includes chilled water, domestic water, storm water and refrigerant: Insulation and vapor barrier shall be continued through wall and firestopping for "insulated piping" shall be provided.
  - 2. Hot piping to 250°F -includes domestic hot water, steam to 15 psig and heating hot water: The Contractor has the option of continuing the insulation through the penetration and providing firestopping for "insulated piping", or stopping the insulation on either side of the penetration and using firestopping for "uninsulated piping".
  - 3. High temperature piping, over 250°F or over 15 psig steam: Contractor shall stop insulation and provide firestopping for "high temperature piping".

# 3.6 HEAT TRACE

- A. Heat trace cable shall be installed by a licensed electrician.
- B. Apply the heat trace cable on the pipe after pressure testing.
  - 1. Do not spiral wrap on pipe.
  - 2. Make one wrap at valves.
  - 3. Secure to pipe with methods approved by manufacturer.
- C. Apply "Electrically Traced" signs on outside of insulation.
- D. Test with a 1000 VDC meager minimum resistance 20 mega ohms.
- E. Heat trace shall be sized as follows, based on 20°F ambient, to maintain 40°F pipe temperature:

| PIPE SIZE    | 1" INSULATION      | 2" INSULATION |
|--------------|--------------------|---------------|
| Less than 2" | 3 w/ft.            | 3 w/ft        |
| 2", 2½", 3"  | 5 w/ft             | 3 w/ft        |
| 4", 5", 6"   | 8 w/ft             | 5 w/ft        |
| 8", 10", 12" | (2 cable circuits) | 8 w/ft        |
|              | 8 w/ft ea.         |               |

# 3.7 EQUIPMENT BASES AND SUPPORTS

- A. Supporting Steel: Provide supporting steel not indicated on the Structural Drawings for equipment, pipe, ductwork, and other pieces of this Division's work requiring same.
  - 1. Submit shop drawings and structural calculations to the Engineer for information and records.
  - 2. Brace and fasten with flanges bolted to structure.

3. Paint supporting steel with one coat of primer paint in the shop after fabrication welding is complete. Paint completed field joints with one coat of matching primer.

# B. Housekeeping Bases:

- Concrete bases for pumps, boilers, tanks, fans, etc., including anchor bolts and inserts, will be provided in accordance with American Concrete Institute (ACI) and American Society for Testing and Materials (ASTM) Standards for housekeeping pads and equipment support bases.
- 2. The concrete shall be placed in accordance with setting diagrams and sizes furnished by the equipment installer.

## 3.8 DRIP PANS

A. Drip Pans:

Where possible to run mechanical piping elsewhere, do not run mechanical piping directly above electrical (or electronic) work which is sensitive to moisture. Otherwise, provide drip pans under mechanical piping, sufficient to protect electrical work from dripping.

- 1. Locate pan immediately below piping, and extend a minimum of 6" on each side of piping and lengthwise 18" beyond equipment being protected.
- 2. Fabricate pans 2" deep of reinforced sheet metal with rolled edges and soldered or welded seams; 22 gauge galvanized steel.
- 3. Provide ¾" copper drainage piping from pan to nearest floor drain or similar suitable point of discharge, and terminate pipe as an open-sight drainage connection.
- 4. Provide permanent support and anchorage to prevent displacement of drip pans.
- 5. Insulate bottom of pan as directed by Engineer.

END OF SECTION 230503

# SECTION 230513 - MOTORS AND STARTERS

## PART 1 – GENERAL

#### 1.1 SUBMITTALS

- A. Submit manufacturer's product data.
  - 1. Motors: Identify by unit served. Include:
    - a. Voltage
    - b. Phase
    - c. Horsepower
    - d. Frame
    - e. Insulating class
    - f. Efficiency
    - g. Power factor
    - h. Index number
    - i. Speed
    - j. Starting characteristics
  - 2. Starters: Identify by motor served. Include:
    - a. Enclosure, NEMA Type
    - b. NEMA size
    - c. Accessories, switches, transformers, etc.
    - d. Wiring diagram
    - e. Auxiliary contacts
    - f. Thermal overload size
  - 3. Submit as part of packaged unit submittals when purchased as part of item of equipment.

# 1.2 SINGLE MANUFACTURER

- A. Provide all motors, except those factory mounted, by a single manufacturer.
- B. Provide all starters, except those factory mounted, by a single manufacturer.
- C. "Factory mounted" means "as part of a packaged unit" where the motor is not purchased separately from the driven equipment.

#### PART 2 – PRODUCTS

# 2.1 MOTORS (OTHER THAN FACTORY MOUNTED)

- A. Manufacturers:
  - 1. Design Basis: Century
  - 2. Other Acceptable Manufacturers:
    - a. General Electric
    - b. Westinghouse
    - c. U.S. Motor
    - d. Allis Chalmers
    - e. Louis Allis
  - 3. Factory mounted motors may be by equipment manufacturer's standard supplier.
- B. Bearings: Ball bearings, grease lubricated with grease fittings.

- C. Enclosure: As required by location.
- D. Service Factor: 1.15.
- E. Full-Load Operation: At 105°F and altitude of project.
- F. Insulation:
  - 1. Constant Speed: Class B.
  - 2. Variable Frequency Controlled: Class F.
- G. Efficiency Ratings:
  - 1. All motors one horsepower and larger, except as noted, shall be premium efficiency motors, in accordance with NEMA Standard MGI-2003, Tables 12-12 and 12-13.
- H. Electrical Characteristics:
  - 1. Refer to sections 230501, Mechanical and Electrical Coordination.
  - 2. Motors  $\frac{1}{2}$  hp and smaller shall be 115-volt single phase.
  - 3. Motors <sup>3</sup>/<sub>4</sub> hp and larger shall be three phase, of voltage shown in Electrical Section of Contract Documents.
- I. Multi-speed Motors:
  - 1. Type: Motors may be one of the following:
    - a. Two speed, two winding 1800/900 rpm.
    - b. Two speed, one winding 1800/900 rpm.
- J. Variable Speed Drives:
  - 1. All motors operated by a variable speed drive shall be rated for inverter duty.
  - 2. Motor insulation shall be rated for 1200-volt peak.
  - 3. Provide shaft grounding Aegis SGR or equal on motors to be used with variable speed drives.

# 2.2 MOTORS (FACTORY MOUNTED)

- A. Provide premium efficiency motors.
- B. Variable Speed Drives:
  - 1. All motors operated by a variable speed drive shall be rated for inverter duty.
  - 2. Motor insulation shall have 1200 volt peak capacity.
  - 3. Provide shaft grounding or insulated bearings on motors to be used with variable speed drives.

# 2.3 STARTERS

- A. Manufacturers:
  - 1. Allen Bradlev
  - 2. Cutler-Hammer
  - 3. General Electric
  - 4. Square D
  - 5. Cerus
- B. General:
  - 1. Starters shall be standard NEMA sizes and UL listed.
- C. Type: Across the line except where noted.
- D. Enclosure: NEMA Type as required for location.

- E. Overload Protection:
  - 1. Type: Trip-free thermal overload relay.
  - 2. Location: Each ungrounded conductor.
  - 3. Reset: Manual.
  - 4. Ambient Temperature Compensation: Provide where required.
  - 5. Overload protection to be sized for nameplate running amps.
- F. Auxiliary Contacts:
  - 1. Provisions to add three without removing starter from enclosure.
  - 2. Number: Provide up to three per starter as required for control sequence, and one (1) auxiliary contact.
  - 3. Switchable type, easily changed from N.O. to N.C. without removing from its mounting.
- G. Switches in Cover:
  - 1. Manually Controlled: Three wire start-stop.
  - 2. Automatically Controlled: Hand-off-automatic.
  - 3. Start and stop indicating lights.
  - 4. Equipment used for life safety (smoke exhaust, etc.): Hand-Automatic.
  - 5. Equipment not designed to run continuously: Off-Automatic.
- H. Control Transformer:
  - 1. Provide when line voltage exceeds 208 volts.
  - 2. Secondary wiring shall have one leg fused and the other grounded.
  - 3. Secondary voltage not to exceed 120 volts.
- I. Provide starters for all motors as follows:
  - 1. Single phase motors less than  $\frac{1}{2}$  hp.
    - a. With internal overload protection: None.
    - b. Without internal overload protection:
      - 1) Manually Controlled: Manual starter.
      - 2) Automatically Controlled: Magnetic starter.
  - 2. Single phase motors  $\frac{1}{2}$  hp and larger:
    - a. Manually Controlled: Manual starter.
    - b. Automatically Controlled: Magnetic starter.
  - 3. Three Phase Motors: Magnetic starter.
- J. Soft Start Starters:
  - 1. Provide Y-Delta or solid state reduced voltage starters for all motors 50hp and larger.
  - 2. Starter shall limit starting voltage to 200% of full load voltage.
- K. Multi-Speed Starters:

2

- 1. Starters shall be suitable for the type multi-speed motor selected.
  - Provide time delay for automatic transfer from high to low speed.
- L. Housing coils to be 120V.
- M. Motor Protection: (above 20 hp)
  - 1. Provide Single-phase protection.
  - 2. Provide under-voltage protection.

# PART 3 – EXECUTION

# 3.1 MOTORS

A. Install motors on motor mounting systems so coupling or belt drive is properly aligned. Provide proper belt tension. Dowel direct coupled motors.

# 3.2 STARTERS

- A. Deliver to installer of electrical work.
- B. All safety devices shall be wired so that they will stop the motor with a hand-off-automatic switch in the hand as well as the automatic position.

END OF SECTION 230513

# SECTION 230521 - PIPE AND PIPE FITTINGS

## PART 1 – GENERAL

### 1.1 QUALITY ASSURANCE

- A. Welder Qualifications: Welders, both on-site and off-site, shall be certified for the type of work being performed by one of the following:
  - 1. National Certified Pipe Welding Bureau.
  - 2. Intermountain Testing Company
- B. Welder Certificates:
  - 1. Submit one copy of certificate to Architect/Engineer.
  - 2. Maintain one copy on project site.

## PART 2 – PRODUCTS

#### 2.1 PIPE AND FITTINGS

- A. Refer to the following sections:
  - 1. 22 10 00 Plumbing Piping
  - 2. 22 21 23 Natural Gas Piping
  - 3. Other Divisions 22 through 23 sections after specific system requirements.

## 2.2 GROOVED PIPE COUPLING SYSTEMS

- A. Manufacturers of Coupling System:
  - 1. Basis of Design: Victaulic
  - 2. Other Acceptable Manufacturers: Grinnell and Gruvlok. Alternate is to provide a system of standard weight black steel pipe with black steel standard weight butt weld or 125 lb cast iron flanged fittings.
  - 3. All couplings, gaskets and joining method adapters shall be provided by one manufacturer. Fittings may be by another manufacturer provided that the groove dimensions comply with the below referenced standards.
- B. Dimensional Standards:
  - 1. All grooved pipe fittings, couplings, and specialties shall conform to standard dimensional standards ANSI/ANWA C-606 or MIL-P-11087C.
- C. Acceptable Products:
  - 1. Only the following grooved pipe products may be used:
    - a. Gaskets: (ASTM D2000) EPDM, for water service, with or without propylene glycol -30°F to 230°F, primary seal by compression of coupling housing, either pressure or vacuum shall assist in sealing force.
    - b. Couplings Steel Pipe: Ductile iron (ASTM A-536) or malleable iron (ASTM A-47), with enamel paint coating.
      - 1) Rigid Couplings: Style 07 zero flex.
      - 2) Flexible Couplings: Style 77, or Style 75.

- c. Flange Adapters: Same materials as couplings. Provide for rigid connection to grooved pipe. Provide flange washers and/or flange gaskets as required for mating to non-standard flanges, such as butterfly valves with elastomeric face, or serrated face flanges.
  - 1) ANSI Class 125 or 150: Style 741.
  - 2) ANSI Class 300: Style 743.
  - 3) Alternate to flange adapter: Flange by groove nipple #41 (Class 125), #45 (Class 150), #16 (Class 300).
- d. Branch Outlet Couplings: Design similar to coupling with integral side outlet.
- e. Fittings for steel pipe: Standard pattern fittings, ductile iron (ASTM A-536), malleable iron (ASTM A-47) or segmentally welded Schedule 40 steel (ASTM A-53) with enamel paint coating. All changes in direction greater than 22° shall be with R=1.5D radius elbow. All branches and changes in direction in drainage piping shall be made with sanitary type lateral branches and R=1.5D elbows.
- f. Accessories: Other piping accessories such as strainers, suction diffusers and flow indicators may be provided with grooved ends, all such accessories shall comply with the applicable specification section.
- 2. All other pipe products shall conform to the requirements of other Divisions 22 through 23 sections. Acceptance of grooved pipe systems does not imply acceptance of the coupling manufactures valves, branch outlets, strainers, or other specialties.

## PART 3 – EXECUTION

## 3.1 PIPE INSTALLATION

- A. General:
  - 1. Install pipe, tube and fittings in accordance with recognized industry practices which will achieve permanently-leakproof piping systems, capable of performing each indicated service without piping failure.
  - 2. Install each run with a minimum of joints and couplings, but with adequate and accessible unions for disassembly, maintenance or replacement of valves and equipment.
  - 3. Reduce sizes by use of reducing fittings.
  - 4. Install piping without springing or forcing.
  - 5. Provide sufficient swing joints, anchors, expansion loops and devices necessary to permit free expansion and contraction without causing undue stresses.
  - 6. Support piping independently at equipment so its weight will not be supported by the equipment.
  - 7. Support piping to maintain a consistent slope as indicated on the drawings without sagging or pocketing of any kind. Where not otherwise indicated, all horizontal piping shall slope a minimum of 1/16 inch per foot to drain at system low points.
  - 8. Provide manual air vents at high points of all pumped piping systems. Provide drains at all low points.
  - 9. Install horizontal piping parallel to building construction, make any changes in direction with fittings.
- B. Location:
  - 1. Locate piping runs, except as otherwise indicated, both vertically and horizontally to allow for complete drainage of piping system (pitched to drain).
    - a. Avoid diagonal runs wherever possible.
    - b. Orient horizontal runs parallel with walls and column lines.

- 2. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of the building.
  - a. Limit clearance to 0.5" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any.
  - b. Where possible, locate insulated piping for 1.0" clearance outside insulation.
- 3. Wherever possible in finished and occupied spaces, conceal piping from view by locating in column enclosures, in hollow wall construction or above suspended ceilings.
  - a. Do not encase horizontal runs in solid partitions, except as otherwise indicated.
- C. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures.
  - 1. Exception: where shown on drawings or where accepted by the Engineer, provide drip pan under piping, and conform to NEC.
  - 2. In no case shall piping run directly above transformers, electrical panels or switchgear.
- D. Dielectric Unions: Install dielectric unions to prevent galvanic action between ferrous and nonferrous piping.
  - 1. Install in an accessible location or provide access doors.

## 3.2 PLASTIC PIPE

- A. Use:
  - 1. Contractor shall take full responsibility that the plastic piping used and its installation meets with the approval of the local authorities.
  - Pipe shall be insulated in air plenums such that the entire installation meets ASTM E84 (NFPA 25) with regard to flame spread and smoke developed ratings suitable for plenum installation.
  - 3. Provide pipe with U.V. inhibitors or paint (under Division 9):
    - a. For all plastic pipe exposed to sunlight or installed in exterior, exposed locations.
    - b. Store PVC without inhibitors indoors.

#### 3.3 WELDING

- A. Welding:
  - 1. Conform to Code for Pressure Piping ANSI B31.
  - 2. Machine cut and bevel piping ends for v-type joints.
  - 3. Use recommended bevels and spacing between ends of pipe to assure full penetration complete to inside diameter of pipe.
- B. Welded Joints:
  - 1. Will be observed visually by the Architect/Engineer.
  - 2. Any weld judged defective from a visual observation, shall be ordered tested at the expense of the Contractor or chipped out for full depth and re-welded.
- C. Welding Fittings:
  - 1. Unless otherwise noted, make all changes in direction and branch take offs with manufactured fittings.
    - a. Use long radius (R=1.50) fittings wherever possible.

- 2. Shop Fabricated Fittings:
  - a. Branches more than two pipe sizes smaller than main line may be made with "weld-o-let" type pre-manufactured saddle fittings.
  - b. Where specifically allowed by the Engineer, angles of less than 22½<sup>0</sup> and branch piping from headers may be made by shop fabricated or manufactured metered fittings.
  - c. Submit shop drawings.
  - d. Thoroughly clean fittings to remove slag.
  - e. Fittings shall be available for observation by the engineer prior to installation.
- 3. In no case will field made miters or weld-o-let fittings be allowed. Exception: Temperature control wells and water treatment taps may be made with weld-o-let fittings in pipe 3" or larger in diameter.

## 3.4 COPPER TUBING JOINTS AND FITTINGS

- A. Unless otherwise noted, make all couplings, changes in direction, branch outlets, and transitions to other materials or joining methods with standard manufactured fittings.
- B. Do not expand or swage piping in lieu of proper solder fittings.
- C. Do not extrude or "pull" branch outlets with "tee-drill" type equipment.
- D. Do not use self tapping type branch outlets.
  - 1. See "hot taps" below.

#### 3.5 THREADED JOINTS AND FITTINGS

- A. All threaded joints shall be made in accordance with American National Standard B2.1.
  - 1. Do not overthread pipe.
  - 2. Apply pipe joint compound on male threads only.
  - 3. Do not use right and left hand threaded joints to make a "union".
- B. Do not thread steel pipe schedule 10 or lighter.
  - 1. UL listed light wall pipe may be threaded in accordance with its listing.

## 3.6 MECHANICAL COUPLING SYSTEMS

- A. All changes in direction shall be made with radius type elbows.
  - 1. Use long radius (R=1.5D) fittings wherever possible.
  - 2. Angles less than 22<sup>1</sup>/<sub>2</sub><sup>0</sup> may be made with pre-manufactured metered fittings.
  - 3. Use of the angular deflection capabilities of grooved pipe couplings for intentional changes of direction shall not be allowed.
- B. All branch outlets shall be made with pre-manufactured 3-way fittings.
  - 1. Shop fabricated Weld-o-let style welded saddle fittings may be used for branches more than two pipe sizes smaller than the main.
  - 2. Mechanical saddle tap fittings shall not be allowed.
- C. Pipe shall be adequately laterally supported to prevent "pipe squirm". Provide a minimum of one hanger per pipe section. No pipe section shall be left unsupported between any two couplings.
  - 1. Rigid type couplings may be considered equivalent to welded or soldered pipe for the above requirements.
- D. Risers more than 20' high shall be made with rigid type couplings.

- E. Grooved pipe systems shall not be considered to be electrically conductive.
  - 1. Provide wire jumpers across all couplings where the piping system is required to be electrically conductive.
  - 2. Cold water piping using grooved pipe systems shall not be used for building ground.
    - a. Provide a engraved plastic sign at the building water entrance stating "Mechanical Coupling System". Not Electrically Conductive".
- F. Flexible couplings may be used for thermal expansion/contraction compensation per manufacturer's recommendations.
- G. Flexible couplings may be used for vibration elimination.
  - 1. Follow manufacturer's recommendation.
  - 2. Provide 3 degrees of freedom by installing sufficient flexible couplings in different orientations.
  - 3. Use spring hangers for all sections of pipe intended for deflection.
  - 4. Roll grooved fittings and pipe shall be considered to have ½ the deflection of cut grooved fittings and pipe.

## 3.7 HOT TAPS

- A. Installing a branch line in piping while under service or static pressure (hot taps) shall only be done where specifically authorized
- B. Submit the proposed method of procedure for each fluid service and pipe material.
  - 1. Hot tap procedure shall remove a plug of main tap material and retrieve it. The plug shall be a maximum of 1 pipe size smaller than the branch size. Hang the removed plug by a chain at the completed tap.
  - 2. Hot tap procedure shall not affect the temperature or pressure rating of the piping system.
  - 3. Hot tap procedure shall be done through a gate or ball valve.

# 3.8 SENSOR WELL TAPS

A. Sensor wells shall be placed in taps made in accordance with the above requirements for branch outlets.

## 3.9 CLEANING, FLUSHING, INSPECTING

- A. Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings, if any.
- B. Flush out water and piping systems with clean water before proceeding with required tests.
- C. See specific pipe service section for further requirements.

#### 3.10 PIPING TESTS

- A. Provide temporary equipment for testing, including pump, thermometer and gauges.
- B. Test piping system before insulation is installed wherever feasible, and remove control devices before testing.
- C. Test each natural section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating.

- D. Fill each section of water, drain or vent piping with water and pressurize for two hours at 150% of operating pressure, but not less than 25 psig for pressure piping, and ten feet of head for drain and vent piping.
- E. Test fails if leakage is observed, or if temperature compensated pressure drop exceeds 1% of test pressure.
- F. Disassemble and re-install sections which fail the test by using new materials to the extent required to overcome leakage.
  - 1. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.
- G. After testing and repair work have been completed, drain test water from piping systems.

## 3.11 MECHANICALLY FORMED TEE CONNECTIONS (DOMESTIC WATER SYSTEMS ONLY)

- A. Mechanically extracted collars shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the branch tube wall so as to comply with the American Welding Society lap joint weld. The collaring device shall be fully adjustable as to ensure proper tolerance and complete uniformity of the joint.
- B. The branch tube shall be notched to conform with the inner curve of the run tube and have two dimple/depth stops (one ¼" atop the other) to insure penetration of the branch tube into the collar is of sufficient depth for brazing, and that the branch tube does not obstruct the flow in the main line tube. Dimple/depth stops will be in line with the run of the tube. The second dimple shall be ¼" above the first and will serve as a visual point of inspection.
- C. All joints shall be brazed in accordance with the Copper Development Association Copper Tube Handbook using BCuP series filler metal. NOTE: Soft soldered joints will not be permitted. Contractor assumes responsibility for joints being installed in accordance with code and manufacturer's recommendation.
- D. All mechanically formed branch collars shall be listed by the Standard Plumbing Code, I.A.M.P.O., S.B.C.C. HUD, U.S. Army Corps of Engineers, NAVFAC, and Underwriters Laboratory. They shall also comply with the ASME Code for pressure Piping ANSI B31.5c.

#### 3.12 PLASTIC PIPING

- A. Do not test with air pressure.
- B. Provide mineral wool fire blanket and tape sealant system to protect all plastic pipe in a return air system.

#### 3.13 PAINTING

A. Exposed piping shall be painted. Pipe shall be cleaned, primed, and painted.

# SECTION 230522 - PIPING ACCESSORIES

PART 1 – GENERAL

- 1.1 SUBMITTALS
  - A. Manufacturer's Data Piping Accessories: Submit manufacturer's data on the following piping accessories:
    - 1. Sealing compound for sleeves.
    - 2. Expansion compensators.
    - 3. Flexible pipe connections.
    - 4. Guides.

# PART 2 – PRODUCTS

## 2.1 MANUFACTURED PRODUCTS

- A. Escutcheon Plates:
  - 1. Type: Split ring
  - 2. Construction: Brass
  - 3. Finish:
    - a. At Painted Surfaces: Prime coat
    - b. At Other Surfaces: Nickel or Chrome plate
  - 4. For Floor Sleeves: Where sleeves extend above floor surface, provide depth to cover sleeve.
- B. Expansion Compensators, Two Inch and Smaller:
  - 1. Manufacturers Design Basis: Metraflex
  - 2. Other Acceptable Manufacturers:
    - a. Adsco
    - b. Keflex
  - 3. Model: Metraloop
- C. Flexible Pipe Connectors:
  - 1. Manufacturers Design Basis: Mason
  - 2. Other Acceptable Manufacturers:
    - a. Metraflex
  - 3. Model: MFTNC, Twin Sphere 225 psi.
- D. Pipe Alignment Guides:
  - 1. Manufacturers Design Basis: Metraflex
  - 2. Other Acceptable Manufacturers:
    - a. Adsco
    - b. Keflex
  - 3. Model: Style IV Spider Type guide
  - 4. Material:
    - a. Spider: Steel for steel pipe, bronze for copper tubing.

- b. Ring: Steel
- c. Travel: 3"

## 2.2 FABRICATED ACCESSORIES

- A. Steel-Pipe Sleeves: Fabricate from Schedule 40 steel pipe. Remove burrs.
- B. Iron-Pipe Sleeves: Fabricate from service weight cast-iron pipe. Remove burrs.
- C. Sheet-Metal Pipe Sleeves: Fabricate from galvanized sheet-metal, closed with lock-seam joints.
  - 1. For following pipe sizes, provide gauge indicated:

| a. | Three Inch Pipe and Smaller: | 20 gauge |
|----|------------------------------|----------|
| b. | Four Inch to Six Inch Pipe:  | 16 gauge |
| C. | Over Six Inch Pipe:          | 14 gauge |

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Pipe Sleeves:
  - 1. Install pipe sleeves where piping passes through walls, floors, ceilings, roofs and structural members, except soil pipe penetrations through concrete slab on grade.
  - 2. Where possible pour sleeve in place or grout.
  - 3. Provide sleeves of adequate size, accurately centered on pipe runs, so that piping and insulation (if any) will have free movement in the sleeve in non-fire rated penetrations.
  - 4. In fire rated penetrations, size sleeves such that the resulting annular space is in accordance with the application requirements of the fire stopping system. Refer to Section 23 05 03. All above grade floor penetrations shall be considered to be fire-rated.
  - 5. Install length of sleeve equal to thickness of construction penetrated, except extend floor sleeves 0.25" above floor finish and, where floor surface drains to a floor drain, extend floor sleeve 0.75" above floor finish.
  - 6. Provide temporary support of sleeves during placement of concrete and other work around sleeves.
  - 7. Provide temporary closure to prevent concrete and other materials from entering pipe sleeves.
  - 8. Except as otherwise indicated, install steel pipe sleeves.
  - 9. At interior partitions and ceiling, install sheet metal sleeves.
  - 10. At exterior penetrations below grade, install iron pipe sleeves.
  - 11. Seal exterior sleeve penetrations at grade weather tight.
- B. Caulking:
  - 1. Where water seal or sound seal, but not fire seal, is needed, (foundation walls, slab on grade): fiberglass backing and heavy bead of silicone caulking compound.
  - 2. Where sleeve pierces a fire separation: Fire stop material in accordance with manufacturer's directions and UL listing. Refer to Section 23 05 03.
- C. Install escutcheon plates at pipe sleeves where piping is exposed to view in occupied spaces of the building, on the exterior, and elsewhere as indicated.
- D. Compensators: Install where shown or where required because piping arrangement does not provide sufficient flexibility.
  - 1. Protect compensators from over-travel and over-stress during remaining installation and testing.
- E. Flexible Connectors: Install at right angles to displacement.
  - 1. Install one end immediately adjacent to isolated equipment and anchor other end.

# DENVER TRAFFIC OPERATIONS COMMAND VEHICLE STORAGE & MODIFICATIONS

- F. Guides: Install where shown and where required in accordance with expansion compensators published requirements.
  - 1. As a minimum, install one guide within four pipe diameters of compensator, and one guide 14 pipe diameters from first guide.

SECTION 230523 - VALVES

## PART 1 – GENERAL

## 1.1 SUBMITTALS

- A. Manufacturer's Data: Submit manufacturer's product data including:
  - 1. Dimensions
  - 2. Sizes
  - 3. End Connections
  - 4. Weights
  - 5. Installation instructions
  - 6. Instructions on repacking and repairing valves.
  - 7. Range of flow for balancing valves and plug valves.
- B. Valve Tag List: Refer to Section 23 05 53 of the Specifications.

# PART 2 – PRODUCTS

## 2.1 VALVES TYPES AND SIZES

## A. General:

- 1. Where type or body material is not indicated, provide valve with pressure class selected from MSS or ANSI standards, based on the maximum pressure and temperature in the piping system.
- 2. All valves in contact with domestic water shall meet the requirements of NSF/ANSI Standard 6.1.
- 3. Except for balancing or otherwise indicated, provide valve of same size as connecting pipe size.
- 4. Unless specifically required by note or symbol, all water valves shall be ball or butterfly valves. If ball, butterfly, globe, plug, or balancing valves are called out by note or symbol, only that type of valve is acceptable.
- 5. Ball valves or butterfly valves may be used in lieu of gate valves when pressure and temperature ratings are adequate.
- 6. Where pipe sizes overlap, contractor has the option of threaded or flanged valves.
- 7. Where grooved pipe mechanical coupling systems are accepted, provide flange adapters to mate with valves as specified below. Valves by the mechanical coupling system manufacturer shall not be used unless they meet all of the specified requirements for a given valve.
- 8. All valves shall be domestically manufactured unless approved for use by Engineer.
- 9. Valves used for domestic water service shall be bronze or stainless steel. Iron and brass body valves are not acceptable.
- 10. All components in hydronic systems shall be compatible with propylene glycol and water solution.

## 2.2 GLOBE AND ANGLE VALVES

- A. Manufacturers:
  - 1. Design Basis: Milwaukee
  - 2. Other Acceptable Manufacturers:
    - a. Crane
    - b. Nibco
    - c. Powell
    - d. Victaulic (for Grooved Pipe Systems)

- e. Gruvlok
- f. Stockham
- B. Size 2" and Smaller: Bronze, 125 psi SWP, 200 psi WOG, rising stem, screwed bonnet. Bronze disk, MSS SP-80, Type 1.
  - 1. Model:
    - a. Globe, Solder Ends: 1502
    - b. Globe, Threaded Ends: 502
    - c. Angle: 504
- C. Size 2½" and Larger: 125 psi SWP, 200 psi WOG, OS&Y bolted bonnet, gland packed, bronze disk, removable bronze seat ring, MSS SP-85.
  - 1. Model:
    - a. Globe: F-2981
- 2.3 SWING CHECK VALVES
  - A. Manufacturers:
    - 1. Design Basis: Milwaukee
    - 2. Other Acceptable Manufacturers;
      - a. Crane
      - b. Nibco
      - c. Powell
      - d. Stockham
      - e. Victaulic (for Grooved Pipe Systems)
      - f. Gruvlock
  - B. Size 2" and Smaller: Bronze, 200 psi SWP, 400 psi WOG, straight or Y-pattern, Bronze Disk, MSS-SP80 Type 3.
    - 1. Model: 508
- 2.4 SILENT/WAFER CHECK VALVES
  - A. Manufacturers:
    - 1. Design Basis: Metra Flex
    - 2. Other Acceptable Manufacturers:
      - a. Cla-Val
      - b. GA Industries
      - c. Nibco
      - d. Tyco
      - e. Victaulic (for Grooved Pipe Systems)
      - f. Gruvlok
      - g. Stockham
  - B. Size 2" and Smaller: Bronze body, 200 psi @ 250 °F, threaded ends, resilient seats, center guided disk.
    - 1. Model: 5700

# 2.5 BUTTERFLY VALVES

- A. Manufacturers:
  - 1. Design Basis: Keystone
  - 2. Other Acceptable Manufacturers:
    - a. Crane
    - b. Center Line
    - c. Nibco
    - d. Keystone
    - e. Victaulic (for Grooved Pipe Systems)
    - f. Hammond Watts
    - g. Bray
    - h. Gruvlok
    - i. Stockham
- B. Water Service (less than 250°F): 200 psi WOG, cast or ductile iron fully lugged body, integral extended neck to clear insulation, integral top plate for actuator mounting, stainless steel stem, upper and lower lubricated bushings, field replaceable hard back seat with integral stem and flange seals, machined disk seating areas, rated for minimum 150 psi dead end service with no downstream flange. Liner to be compatible with operating fluid. Conform to MSS-SP67.
  - 1. Disk Material 8" and Under and all sizes for condenser or domestic water: Aluminum bronze.
  - 2. Disk Material, 10" and Larger: Nickel plated ductile iron.
  - 3. Model: Figure 2-22.
- C. Steam/High Temperature Water Service: Suitable for bubble tight bi-directional dead-end service at 125 psi 350°F saturated steam or water cast iron body, stainless steel disk, field replaceable reinforced TFP seats, gland packed stem seal, extended neck to clear 2" insulation. Conform to MSS SP-63.
  - 1. Model: K-LoK
- D. Accessories:
  - 1. 10 position locking lever handler for valves 6" and smaller.
  - 2. Infinite position memory stop lever handle for all valves 6" and smaller used for balancing.
  - 3. Hand wheel gear operator for valves 8" and larger.
  - 4. Chain wheel operator where required.

# 2.6 GATE VALVES

- A. Manufacturers:
  - 1. Design Basis: Milwaukee
  - 2. Other Acceptable Manufacturers:
    - a. Crane
    - b. Nibco
    - c. Stockham
    - d. Victaulic (for Grooved Pipe Systems)
    - e. Gruvlok
- B. Size 2" and Smaller: Bronze, 200 psi SWP, 400 psi WOG, rising stem, union bonnet, gland packed, stainless steel seat rings.
  - 1. Model: 1174

- C. Size 2<sup>1</sup>/<sub>2</sub>" and Larger: Cast iron, 125 psi SWP, 200 psi WOG, gland packed, bolted bonnet, OS&Y, solid wedge disk, either all bronze or with bronze face ring, bronze seat rings, brass back seat bushing, brass stem, bronze yoke bushing.
  - 1. Model: F2885
- 2.7 BALL VALVES
  - A. Manufacturers:
    - 1. Design Basis: Nibco
    - 2. Other Acceptable Manufacturers:
      - a. Apollo
      - b. Dyna Quip
      - c. Hammond
      - d. Milwaukee
      - e. Victaulic (for Grooved Pipe Systems)
      - f. Watts
      - g. Bray
      - h. Gruvlok
      - i. Stockham
  - B. Bronze, 150, SWP, 600 WOG (min), chrome plated solid, tunneled bronze ball (stainless for steam service), two piece design, blow-out proof stem, adjustable packing gland nut (allowing handle to be removed without leaking) TFE seats, MSS-SP-110.
    - 1. Model: T-585-70 full.port.
  - C. Options: Provide the following where required:
    - 1. Extended stems for insulated valves.
    - 2. Memory stop device for balancing applications.
    - 3. Tee handle for tighter areas.
    - 4. Hose end and cap for drain.
    - 5. Mounting pads for actuator.

## 2.8 BALANCING VALVES

- A. Manufacturer, variable orifice type:
  - 1. Armstrong
  - 2. Tour and Anderson
  - 3. Nibco
- B. Manufacturers, valve and venturi type:
  - 1. Flow Design Inc.
  - 2. Gerand
  - 3. Griswold
  - 4. HCI
  - 5. Nexus
  - 6. Preso
- C. 175 psi at 250°F.
- D. Connections: Threaded or flanged.
- E. Pressure Reading Ports:
  - 1. "P/T" Ports, Shraeder valves, or Hansen type quick connect. No "refrigeration" fittings.

- F. Design, variable orifice type:
  - 1. Globe-type valve.
  - 2. Multiple turns of handwheel from full closed to full open.
  - 3. Bubble-tight shut-off.
  - 4. Taps upstream and downstream.
  - 5. Memory stop device to allow valve to be returned to balanced position after being closed.
- G. Design, valve and venturi type:
  - 1. Ball valve complying with the above requirements for ball valves.
  - 2. Fixed orifice or venturi, upstream of valve.
  - 3. Taps on venturi, upstream and downstream.
  - 4. Memory stop device to allow valve to be returned to balanced position after being closed.
  - 5. Regardless of the manufacturer's claims, these valves shall not be considered as tight shut off for service. Provide additional valves for equipment isolation.
- H. Insulation: Provide premolded insulation conforming to the valve body. Material shall have a flame spread of 25 and a smoke development of 50.

# 2.9 CIRCUIT SETTERS (CS)

- A. Manufacturers:
  - 1. Design Basis
    - a. Bell & Gossett/ITT
  - 2. Acceptable Manufactures:
    - a. Prior Engineer Approval for Substitutions
- B. Construction:
  - All valves to be of bronze body/brass ball construction with glass and carbon filled TFE seat rings. Valves to have differential pressure read-out ports across valve seat area. Read-out ports to be fitted with internal EPT insert and check valve. Valve bodies to have ¼" NPT tapped drain/purge port. Valves to have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position. All valves to have calibrated nameplate to assure specific valve setting. Valves to be leaktight at full rated working pressure.
- C. Valves 1/2" to 2" pipe size, NPT or sweat valves 2 1/2' and 3" pipe size, NPT.
- D. Pressure/Temperature 175 psig at 250°F.

# 2.10 COMBINATION THROTTLING/CHECK VALVES

- A. Manufacturers:
  - 1. Basis of Design: Bell & Gossett Triple Duty Valve.
  - 2. Other Acceptable Manufacturers:
    - a. Armstrong
    - b. Taco
    - c. Victaulic (for Grooved Pipe Systems)
    - d. Watts
- B. Features:
  - 1. 175 psi, 250°F water working pressure.
  - 2. Globe style valve with stainless steel spring loaded brass disk guided and limited by a brass or stainless steel stem.

- 3. Resilient seat.
- 4. Able to be re-packed under pressure.

## 2.11 DRAIN VALVES

A. Gate or ball valve with hose end adapter and cap.

## 2.12 PLUG VALVES

- A. Manufacturers:
  - 1. Design Basis: Keystone
  - 2. Other Acceptable Manufacturers:
    - a. Dezurik
- B. Model: "Ballcentric"; cast-iron, full port body; EPDM coated plug; welded nickel seat; stainless steel bearings; integral memory stop device; hand wheel operator for valves 6" and larger.

# PART 3 - EXECUTION

## 3.1 GENERAL

- A. Comply with the following requirements:
  - 1. Install valves except butterfly with stems pointing up, and as close to vertical as possible. Butterfly valves to be offset at least 10° from vertical.
  - 2. Install valves at each piece of equipment, fixture or appliance so that the supply and return services can be shut off to remove the item without draining the remainder of the piping system.
  - 3. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping.
    - a. Locate valves so as to be accessible.
  - 4. Combination balancing and shut-off valves may be used instead of a separate balancing valve and shut-off valve if the valve has a memory stop and the manufacturer lists its use as a leak-proof service valve.
  - 5. Provide drain valves at main shut-off valves, low points of piping and apparatus.
  - 6. Provide separate support where necessary.
  - 7. Do not allow meter connections of balancing valves to point downward.
  - 8. Install valves so bypass valves are accessible.
- B. All valves of a given type shall be of one manufacturer.
- C. Provide extended stems on insulated system to prevent interference of operator with insulation.
- D. Provide chain wheel operators for valves more than 8' 0" AFF in mechanical rooms and wherever shown on drawings.

## 3.2 CHECK VALVE INSTALLATION

- A. Swing and Check Valves:
  - 1. Install only in horizontal lines unless absolutely impractical. If installed vertically, flow shall be upwards.
  - 2. Do not install in pump discharge piping.
- B. Silent Check Valves:
  - 1. Install in all pump discharge lines.

2. Silent check valves may be installed in vertical pipes with flow down upon Engineer's review for each instance.

## 3.3 VALVES USED FOR THROTTLING/BALANCING

- A. Balancing valves shall not be used for flow indication in pipes 2½" and larger, or in pump discharge piping.
- B. Flow indication in piping 2½" and larger and in pump discharge piping, shall be by a venturi with a plug, butterfly, or globe valve for throttling.
- C. Throttling/Balancing Valves shall be selected so that the maximum design flow causes between 1' and 10' W.G. pressure drop or meter reading with the valve wide open.
- D. Install balancing valves used for flow indication with a minimum of five times the pipe diameter downstream and two times the pipe diameter upstream of a fitting or valve.
- E. Globe, ball, butterfly, or plug valves may be used for throttling/balancing. Provide an infinitely variable, lockable memory stop device to allow the valve to be returned to the "balanced" position after closing, and to prevent movement of the disk or plug during operation. When ball valves are used for throttling, provide an additional valve for equipment isolation.

# 3.4 COMBINATION THROTTLING/CHECK VALVES

A. Combination throttling/check valves may be used in lieu of separate throttling and check valves on pump discharge piping. However, they may not be used for flow measurement.

## 3.5 CIRCUIT SETTERS

A. All circuit setters shall be installed per manufactures recommendations. Provide manufacturers recommendation for required straight pipe for inlet and outlet connections to provide accurate ratings. Setting shall be 1 GPM unless other wise noted on drawings.

# SECTION 230529 - PIPE SUPPORTS AND ANCHORS

## PART 1 – GENERAL

## 1.1 STANDARDS

A. Comply with MSS Standard Practice SP-69, published by Manufacturer's Standardization Society of the Valve and Fitting Industry for type and size.

## 1.2 SUBMITTALS

- A. Submit manufacturer's product data on the following:
  - 1. Hangers other than clevis type.
  - 2. Anchors.
- B. Submit structural calculations on trapeze type supports.

# PART 2 – PRODUCTS

## 2.1 PIPE HANGERS

- A. General:
  - 1. Use adjustable pipe hangers on suspended pipe. Trapeze hangers may be used at the Contractor's option. Contractor shall be responsible for sizing supports.
  - 2. Chain, wire or perforated strap hangers will not be permitted.
  - 3. Isolate hangers in contact with dissimilar materials with dielectric hanger liners. Tape is not acceptable.
  - 4. Provide supports between piping and building structure where necessary to prevent swaying.
- B. Hanger and Rod Material:
  - 1. Exposed in public areas: Zinc electroplated steel.
  - 2. Concealed or in service areas: Black threaded steel.
  - 3. Outside, exposed to weather: Hot dipped galvanized.
  - 4. Buried below structural slab: Stainless Steel
- C. Spot Concrete Inserts: Steel case and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods and lugs for attaching to forms.
  - 1. Size inserts to match size of threaded hanger rods.
  - 2. Inserts to be UL and FM listed.
  - 3. Minimum 1000 lb. Capacity with ½" rod.
- D. Channel Type Inserts:
  - 1. Standard channel support with anchor tabs on 4" centers, and nail holes for attaching to forms.
  - 2. Styrofoam inserts to prevent wet concrete seepage.
  - 3. Minimum 2000 pounds/foot capacity.
- E. Expansion Anchors:
  - 1. For use only where modifications to piping layouts to change from pre-installed insert locations.
  - 2. Inserts shall be of the drill, insert, expand type. Power driven fasteners are not acceptable for piping.
  - 3. Contractor shall select the appropriate type based on the following:

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| Rod Size | Maximum Working Load |
|----------|----------------------|
| 3/8      | 600 pounds           |
| 1/2      | 1100 pounds          |
| 5/8      | 1800 pounds          |
| 3/4      | 2700 pounds          |
| 7/8      | 3700 pounds          |

- F. Steel Structure Attachments:
  - 1. Contractor may select welded or mechanically attached. All mechanically attached supports shall have jam nuts or other means to prevent loosening. Maximum loading requirements are as follows:

| Rod Size | Maximum Working Load |
|----------|----------------------|
| 3/8      | 600 pounds           |
| 1/2      | 1100 pounds          |
| 5/8      | 1800 pounds          |
| 3⁄4      | 2700 pounds          |
| 7/8      | 3700 pounds          |

- G. Single Hangers:
  - 1. Piping 2" and smaller: MSS type 1, Clevis hanger or type 7 adjustable swivel ring hanger. Minimum 180 pounds design load.
  - 2. Piping 2<sup>1</sup>/<sub>2</sub>" and larger: MSS type 1 Clevis hanger.
  - 3. Bare copper pipe: Above hangers, plastic or Neoprene coating, sized for copper pipe O.D. and copper coated for identification.
  - 4. Insulated pipe: Hangers to be sized for O.D. of insulation. Hangers shall not penetrate any insulation.
- H. Trapeze hangers and wall supports:
  - 1. Channel strut or structural steel shapes. Contractor shall follow channel strut manufacturers guidelines for loading or provide structural steel supports designed by a professional Engineer, licensed in the same state as where the project is located.
  - 2. All piping shall be attached to the support by means of a channel strut clamp, U-bolt, or pipe rollers which will maintain lateral position of the pipe but allow longitudinal movement. Provide dielectric isolation between all dissimilar metals.
  - 3. All insulation shall be continuous at supports. Do not notch or penetrate insulation.
- I. Vertical Supports: Steel riser clamp at each floor penetration or every 14 foot supported from wall bracket. Do not anchor riser clamps.
- J. Hangers:
  - 1. General: Adjustable wrought steel clevis with locking nut attachment.
  - 2. Multiple or Trapeze: Steel channels with welded spacers and hanger rods.
  - 3. Hanger Sizes and Spacing:
    - a. For gas, domestic water and drain piping, conform to the IPC for spacing, and the following table for hanger rod sizes.
    - b. For steam and hydronic piping, conform to the following table:

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| PIPE TYPE      | PIPE SIZE                                          | MAXIMUM SPACING           | MINIMUM HANGER ROD<br>SIZE           |
|----------------|----------------------------------------------------|---------------------------|--------------------------------------|
| Steel Pipe     | 1/2"                                               | 6'-0"                     | 3/8"                                 |
| •              | ¾" thru 1¼"                                        | 8'-0"                     | 3/8"                                 |
|                | 1½" and 2"                                         | 10'-0"                    | 3/8"                                 |
|                | 21/2" thru 31/2"                                   | 12'-0"                    | 1/2"                                 |
|                | 4" and 5"                                          | 15'-0"                    | 5/8"                                 |
|                | 6"                                                 | 17'-0"                    | 3/4"                                 |
| *              | 8" thru 12"                                        | 12'-0"                    | 7/8"                                 |
| *              | 14" thru 18"                                       | 10'-0"                    | 1¼"                                  |
| *              | 20" thru 30"                                       | 8'-0"                     | 1½"                                  |
| Copper Pipe    | ½" thru 1"<br>1¼" thru 2"<br>214" thru 2"          | 6'-0"<br>10'-0"<br>10' 0" | 3/8"<br>3/8"                         |
| Cast Iron Soil | 21⁄2" thru 3"<br>2"<br>3" to 5"<br>6"<br>8" to 12" | 10'-0"                    | 1/2"<br>3/8"<br>1/2"<br>5/8"<br>3/4" |
|                | =                                                  |                           | • •                                  |

\* Submit routing and support plans to Architect/Engineer for review.

K. Insulated Pipe Supports:

1. Size pipe supports for outside diameter of pipe insulation.

L. Wall Supports:

2.

- 1. <sup>1</sup>/<sub>2</sub>" through 3": Unistrut type channel and steel clamp.
  - a. Use Hydrosorb cushions on copper pipe.
  - 4" and Over: Welded steel bracket and wrought steel clamp.
- M. Pipes over five inches and over 120°: Provide cast iron roller supports.

# 2.2 INSULATION INSERTS

- A. Pipe shall be protected at the point of support by a 360° insert of high density, 100 psi, waterproofed calcium silicate, encased in a sheet metal shield. Insert to be same thickness as adjoining pipe insulation. Insulation insert to extend one inch beyond sheet metal shield on all "cold" lines. If pipe hanger spacing exceeds ten feet and for all pipe roller applications, utilize double layer shield on bearing surface.
- B. Provide 180° insulation inserts when utilizing clevis hangers. Provide 360° insulation inserts at all trapeze and wall supports.

#### 2.3 PIPE ANCHORS

- A. Manufacturers:
  - 1. Design Basis: Flexonics
  - 2. Other Acceptable Manufacturers:
    - a. Adsco
    - b. Keflex
    - c. Hilti

- B. Model AC with threaded ends and welded angle brackets for steel pipe.
- C. Model AC copper tube with solder ends and steel angle brackets brazed to tubing for copper tube.
- D. Anchors may be field fabricated similar to manufactured products specified.

# 2.4 PIPE GUIDES

- A. Manufacturers:
  - 1. Basis of Design: B-line.
  - 2. Other Acceptable Manufacturers:
    - a. Fee & Mason
    - b. Grinnel
    - c. M-Co
    - d. PHD
- B. Any of the Following:
  - 1. Spider Type: B3281-7.
  - 2. Roller Type: 2 sets of roller son opposite sides of pipe.
  - 3. Slide Type: B3893 with hold down lugs.
    - a. Not for use with cold piping.
  - 4. Light duty, 1½" and smaller copper: U bolt or channel strut clamp (B2417) allowing clearance from O.D. of pipe or insulation.

# 2.5 ROOF MOUNTED PIPING

- A. Manufacturers:
  - 1. Miro Industries, Inc.
  - 2. Portable Pipe Hangers, Inc.
  - 3. Approved Equivalent.
- B. Description: Piping on roof shall be supported by an engineered prefabricated portable pipe system specifically designed to be installed on the roof without roof penetrations, flashing or damage to the roofing material. The system shall consist of recycled rubber or plastic bases, hot dipped galvanized or stainless steel frame with threaded rods and suitable pipe hangers and supports. The system shall be custom designed to fit the piping and conduits to be installed and the actual conditions of service.
- C. Provide seismic restraints as required for seismic zone. See 23 05 49.

# PART 3 - EXECUTION

# 3.1 INSTALLATION OF PIPE SUPPORTS

- A. Adequately support piping from the building structure with adjustable hangers to maintain uniform grading where required and to prevent sagging and pocketing.
  - 1. Provide supports between piping and building structure where necessary to prevent swaying.
  - 2. Do not support pipe from other pipe or equipment.
  - 3. Provide thrust restraints at all changes in direction on 8" and larger cast iron piping with no hub or hub and spigot fittings.

- B. Install hangers to provide minimum ½" clear space between finished covering and adjacent work.
  - 1. Place a hanger within one foot of each horizontal elbow.
  - 2. Space hangers generally as called for in Table in Part 2, Products.
- C. Use hangers, which are vertically adjustable 1-½" minimum after piping is erected.
- D. Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.
  - 1. Set inserts in position in advance of concrete work.
  - 2. Where concrete slabs form finished ceiling, finish inserts flush with slab surface.
  - 3. Do not penetrate concrete "TT" legs for piping inserts. Do not penetrate the stressed (i.e. lower) chords of any structural member.
- E. Provisions for Movement: Install hangers and supports:
  - 1. To allow controlled movement of piping systems.
  - 2. To permit proper movement between pipe anchors.
  - 3. To facilitate the action of expansion joints, expansion loops, bends and offsets.
  - 4. To isolate force due to weight or expansion from equipment connections.
- F. In general, attach hangers to upper chord of roof trusses and floor joists, using long rods to facilitate pipe movement.
- G. Anchors:
  - 1. Securely anchor piping where indicated or where required for a proper installation and to force the pipe expansion in the proper direction.
  - 2. Anchors shall be suitable for the location of installation and shall be designed to withstand not less than five times the anchor load.
  - 3. Anchor vertical pipes by means of clamps welded around pipes and secured to wall or floor construction. Anchor at bottom of riser only but provide guides for vertical thermal movement.

# SECTION 230530 - ELECTRONIC SPEED CONTROLLERS

# PART 1 – GENERAL

## 1.1 SUBMITTALS

- A. Submit manufacturer's product data for each unit. Include:
  - 1. Capacity:
    - a. Horsepower
    - b. KVA
    - c. Amps
  - 2. Wiring Diagrams:
    - a. Include diagrams for basic unit and for all required accessories.
  - 3. Dimensions.
  - 4. Installation instructions.
  - 5. Description of diagnostic system.
  - 6. Options provided.
  - 7. Time-current curves for VFD circuit.

# PART 2 - PRODUCTS

- 2.1 GENERAL
  - A. Manufacturer:
    - 1. Basis of Design:
      - a. Toshiba
    - 2. Other Acceptable Manufacturers:
      - a. Reliance
      - b. Robicon
      - c. Hitachi
      - d. Magnetek
      - e. Cutler-Hammer
      - f. ABB
      - g. Danfoss
      - h. General Electric
      - i. Trane
  - B. Single Manufacturer
    - 1. Provide all drives, except those factory mounted, by a single manufacturer.
    - 2. "Factory Mounted" means as part of a packaged unit where the drive is not purchased separately from the driven equipment.
  - C. Drive shall convert the constant frequency AC line voltage to a variable frequency, variable voltage AC output suitable for control of a standard NEMA design B induction motor over a 10:1 speed range and with full load amp rating between 10% and 110% of the drive full load current capability and without modification to the motor or the drive.
  - D. Variable frequency drives for motors greater than 5 HP shall have the following features:
    - 1. Drive input: 480 volts <u>+</u> 10%, 3 phase, 60 Hz.

- 2. Drive output: 0-460 volts, 3 phase, 0-80 Hz. For efficient operation of a variable torque load.
- 3. Drive type: Pulse width modulation type, designed to minimize harmonic generated noise in the motor.
- 4. Enclosure type: Based on mounting environment. For units located outside, or exposed to ambient conditions, provide internal enclosure heater.
- 5. AC line fused disconnect or circuit breaker.
- 6. Metal oxide varistors on incoming line for transient protection.
- 7. Control power transformer with fused primary and 24V or 120V fused secondary.
- Manual, speed adjustment potentiometer of keypad, HAND-OFF-AUTO switch, and 4-20 milliamp signal follower, fully isolated and suitable for grounded or ungrounded input signal. Drive manufacturer shall coordinate exact signal type with temperature control contractor.
- 9. Instantaneous overcurrent shutdown with indicator light when current exceeds 200%. Time-overcurrent overload protection for the motor.
- 10. Inverse characteristic time-overcurrent overload protection for the motor sized in accordance with NEC requirements.
- 11. Drive shall be capable of withstanding random application of an output short circuit without damage to drive components or fuses.
- 12. Input phase loss and undervoltage protection.
- 13. Torque/current limit control which will slow the motor without tripping when the motor is subjected to an overload, or slow the acceleration ramp when accelerating a high inertia load.
- 14. Drives shall be capable of "riding through" a momentary loss of power for up to 2 seconds.
- 15. AC line reactors in the drive cabinet for protection against line notching and surges without requirement for an input isolation transformer.
- 16. Power factor shall be minimum 95% at all speeds and loads.
- 17. Each drive shall have the following status and troubleshooting diagnostic features:
  - a. Auto restart in "auto" mode. Certain drive faults shall be selectable to bypass the auto restart feature. Auto restart manual shall only be attempted 5 times.
  - b. Exterior drive door mounted devices shall include"
    - 1) "Power On" pilot light.
    - 2) "VFD Run" pilot light.
    - 3) % full load digital display.
    - 4) Output frequency and/or % speed digital meter.
  - c. Indicator lights on each power module to indicate correct operation (or failure) of individual owner switching devices.
  - d. DRIVE/OFF/LINE test switch.
- 18. UL listed or ETL listed.
- 19. Minimum and maximum speed adjustment.
- 20. Factory Tests: The VFD shall be tested with the system logic and given complete factory tests including simulated operation.
  - a. Provide certification this test has been made for the particular units shipped for this job.
- 21. Field Adjustments: Independent acceleration/deceleration rates: 0.5 120 seconds.
- 22. Provide a maximum of 1000 volts at the motor terminals.
- 23. Provide LAN card connection to interface with Building Automation System. Coordinate control protocols with BMS contractor.
- 24. Provide auxiliary contacts for connection to smoke control system. VFD to be UL864 listed for smoke management.

- E. All variable frequency drives shall be equipped with a manual bypass device to allow for total isolation of the drive unit for service while providing for temporary operation of the motor. This shall include:
  - 1. A main disconnect switch in the bypass enclosure with a door interlock handle. This disconnect shall provide positive shutdown of all power to both the bypass circuitry and the VFD.
    - a. For motors on emergency, or life safety systems, the bypass shall be in a separate compartment from the VFD. The installation shall allow for removal of the VFD while maintaining operation of the load.
  - 2. With the "H-O-A" switch in the "OFF" position, the run circuit will be open and the VFD will not operate.
  - 3. A VFD output contactor and a constant speed contactor.
  - 4. A three pole motor overload relay with heaters connected to shut down the motor in both the VFD and bypass modes.
  - 5. A control relay and terminal blocks which will allow two-wire, start-stop control of the motor from a single remote contact in both VFD and BYPASS (AUTO) modes of operation.
  - 6. A control relay and terminal blocks to allow connection of remote interlock shutdown contacts such as freezestats, smoke detectors, etc. When this interlock loop is opened, operation of the motor shall be disabled in both VFD and bypass modes.
  - 7. A three position selector switch shall be provided, VFD-OFF-BYPASS.
  - 8. Indicator lights on the face of the bypass panel shall be provided as follows: Indicators shall be long life neon or transformer type incandescent types.
    - a. "POWER ON"
    - b. "MOTOR ON VFD"
    - c. "MOTOR ON BYPASS CONTROL"
    - d. "MOTOR OVERLOAD"
    - e. "INTERLOCK SHUTDOWN"
  - 9. 120V control power transformer with fused secondary and primary. Bypass mode operation shall be independent of VFD control power.
  - 10. VFD output contactor shall be wired to allow a controlled VFD deceleration ramp to stop.
  - 11. Panel shall be arranged to allow power-off maintenance of VFD while motor is operation on bypass. Bypass circuitry in the same compartment as the VFD will not be allowed.
- F. In addition to the above feature all drives shall have the following additional features:
  - 1. Catch-a-spinning load capability.
  - 2. Critical speed avoidance capability.
  - 3. Where the building walls are not suitable for mounting drives a floor stand kit shall be provided.
  - 4. Where required by Division 23 09 01, provide output isolator to provide VFD signal operation of frequency, and current to an isolated 4-20 mA signal for transmission to the building automation system for monitoring capability.
- G. For variable frequency drives serving multiple motors, the following shall be provided:
  - 1. Provide motor contactors for each motor for drives serving more than one motor, each contactor shall have auxiliary contacts to prevent drive damage if remote motor disconnect switch is open of closed.
  - 2. Each drive shall have contactors for each motor it serves with individual thermal overload protection for each motor and H-O-A motor select switch.
  - 3. All multiple motor variable speed controllers shall be capable of operating even if one of the motors is off.
- H. For drive manufacturers who use portable test meter for diagnostics, provide not less than one test meter for each model or type used. Meters shall be supplied to the Owner upon completion of the project.
- I. Provide one complete set of spare fuses for all variable speed controllers.

J. Interlock all disconnects with variable speed drive so variable speed drive opens before disconnect opens to prevent damage to the drive.

# PART 3 – EXECUTION

- 3.1 Deliver units to installer of electrical work. Provide installation and wiring instruction and diagrams.
- 3.2 Provide wiring control diagrams and instructions to installer of automatic temperature controls.
- 3.3 Provide factory representative at start-up to check installation and instruct Owner.

# SECTION 230548 - VIBRATION CONTROL

## PART 1 – GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplemental Conditions of the Construction Contract, and Division 1 Specification Sections (General Requirements), apply to this Section.

## 1.2 DESCRIPTION

A. Furnish and install vibration control devices, materials, and related items. Perform all work as shown on the drawings and as specified herein to provide complete vibration isolation systems in proper working order.

## 1.3 MATERIAL AND EQUIPMENT

- A. Design Basis: Mason Industries
- B. Alternate Manufacturers:
  - 1. Amber/Booth Co.
  - 2. Kinetics Noise Control
  - 3. Korfund Dynamics Corp.
  - 4. Vibration Eliminator Co.
  - 5. Vibration Mountings & Controls, Inc.
- C. Unless otherwise specified, supply only new equipment, parts and materials.

#### 1.4 QUALITY ASSURANCE

- A. Coordinate the size, location, and special requirements of vibration isolation equipment and systems with other trades. Coordinate plan dimensions with size of housekeeping pads.
- B. Provide vibration isolators of the appropriate sizes, with the proper loading to meet the specified deflection requirements.
- C. Supply and install any incidental materials needed to meet the requirements stated herein, even if not expressly specified or shown on the drawings, without claim or additional payment.
- D. Verify correctness of equipment model numbers and conformance of each component with manufacturer's specifications.
- E. Should any rotating equipment cause excessive noise or vibration, the Contractor shall be responsible for rebalancing, realignment, or other remedial work required to reduce noise and vibration levels. Excessive is defined as exceeding the manufacturer's specifications for the unit in question.

# 1.5 SUBMITTALS

- A. Reference Division 1.
- B. Prior to ordering any products, submit shop drawings or the items listed below. The shop drawings must be complete when submitted and must be presented in a clear, easily understood form. Incomplete or unclear presentation of shop drawings may be reason for rejection of the submittal.
  - 1. A complete description of products to be supplied, including product data, dimensions, specifications, and installation instructions.

- 2. Detailed selection data for each vibration isolator supporting equipment, including:
  - a. The equipment identification mark;
  - b. A cut sheet of the isolated equipment showing equipment support points and operating weight at each point.
  - c. The isolator type;
  - d. The actual load;
  - e. The static deflection expected under the actual load;
  - f. Specified minimum static deflection;
  - g. The additional deflection-to-solid under load;
  - h. The ratio of spring height under load to spring diameter.
- 3. Steel rails, steel base frames, and concrete inertia bases showing all steel work, reinforcing, vibration isolator mounting attachment method, and location of equipment attachment bolts.
- 4. Special details necessary to convey complete understanding of the work to be performed.

## PART 2 - PRODUCTS

## 2.1 VIBRATION ISOLATION MOUNT TYPES

- A. General:
  - 1. All metal parts of vibration isolation units installed out-of-doors shall be cold-dip galvanized, cadmium plated, or neoprene coated after fabrication. Galvanizing shall meet ASTM Salt Spray Test Standards and Federal Test Standard No. 14.
  - 2. All isolators installed out-of-doors shall have base plates with bolt holes for fastening the isolators to the support members.
  - 3. Isolator types are scheduled to establish minimum standards. At the Contractor's option, laborsaving accessories can be an integral part of isolators supplied to provide initial lift of equipment to operating height, hold piping at fixed elevations during installation and initial system filling operations, and similar installation advantages. Accessories must not degrade the vibration isolation system.
  - 4. Static deflection of isolators shall be as provided in SECTION 3 EXECUTION. All static deflections stated are the minimum acceptable deflection for the mounts under actual load. Isolators selected solely on the basis of rated deflections are not acceptable and will be disapproved.
- B. Type FSN (Floor Spring and Neoprene)
  - 1. Spring isolators shall be freestanding and laterally stable without any housing. Spring diameter shall be not less than 0.8 of the compressed height of the spring at the rated load. Springs shall have a minimum additional travel-to-solid equal to 50% of the rated deflection. Springs shall be so designed that the ratio of horizontal stiffness to vertical stiffness is approximately one (1). All mounts shall have leveling bolts.
  - 2. Either the spring element in the isolator shall be set in a neoprene cup and have a steel washer to distribute the load evenly over the neoprene, or each isolator shall be mounted on a Type NP isolator. If the NP isolator is used, provide a rectangular bearing plate of appropriate size to load the pad uniformly within the manufacturer's recommended range.
  - 3. If the basic spring isolator has a neoprene friction pad on its base and a NP isolator is to be added to the base, a galvanized steel, stainless steel or aluminum plate shall be used between the friction pad and the NP isolator. If the isolator is outdoors, the plate shall not be made of galvanized steel. The NP isolator, separator plate and friction pad shall be permanently adhered to one another and to the bottom of the bearing plate.
  - 4. If the isolator is to be fastened to the building structure and Type NP isolator is used under the bearing plate, neoprene grommets shall be provided for each bolt hole in the base plate. Bolt holes shall be properly sized to allow for grommets. The hold down bolt assembly shall include washers to distribute load evenly over the grommets. Bolts and washers are to be galvanized.

Type FSN isolators shall be Mason Type SLF with the appropriate neoprene pad (if used) selected from Type NP or approved equal.

- C. Type FSNTL (Floor Spring and Neoprene Travel Limited)
  - Spring isolators shall be freestanding and laterally stable without any housing. Spring diameter shall not be less than 0.8 of the compressed height of the spring at the rate load. Spring shall have a minimum additional travel-to-solid equal to 50% of the rated deflection. Springs shall be so designed that the ratio of horizontal stiffness to vertical stiffness is approximately one (1). All mounts shall have leveling bolts. All mounts shall have vertical travel limit stops to control extension when weight is removed. The travel limit stops shall be capable of serving as blocking during erection of the equipment. A minimum clearance of ¼" shall be maintained around restraining bolts and between the limit stops and the spring to avoid interference with the spring action.
  - 2. Either the spring element in the isolator shall be set in a neoprene cup and have a steel washer to distribute the load evenly over the neoprene, or each isolator shall be mounted on a Type NP isolator. If the NP isolator is used, provide a rectangular bearing plate of appropriate size to load the pad uniformly within the manufacturer's recommended range. If the basic spring isolator has a neoprene friction pad on its base and a NP isolator is to be added to the base, a galvanized steel, stainless steel or aluminum plate shall be used between the friction pad and the NP isolator. If the isolator is outdoors, the plate shall not be made of galvanized steel. The NP isolator, separator plate, and friction pad shall be permanently adhered to one another and to the bottom of the bearing plate.
  - 3. If the isolator is to be fastened to the building structure and Type NP isolator is used under the bearing plate, neoprene grommets shall be provided for each bolt hole in the base plate. Bolt holes shall be properly sized to allow for grommets. Hold down assembly shall include washers to distribute load evenly over the grommets. Bolts and washers are to be galvanized.

Type FSNTL isolators shall be Mason Type SLR with the appropriate neoprene pad (if used) selected from Type NP or approved equal.

- D. Type FN (Floor Neoprene)
  - 1. Neoprene isolators shall be neoprene-in-shear type with steel reinforced top and base. All metal surfaces shall be covered with neoprene. The top and bottom surfaces shall be ribbed. Bolt holes shall be provided in the base and the top shall have a threaded fastener. The mounts shall include leveling bolts that may be rigidly connected to the equipment.

Type FN isolators shall be Mason Type ND or approved equal.

- E. Type NP (Neoprene Pad)
  - 1. Neoprene pad isolators shall be one layer of ¼" to 3/8" thick ribbed or waffled neoprene. The pads shall be sized so that they will be loaded within the manufacturer's recommended range.

Type NP isolators shall be Mason Type W or approved equal.

- F. Type DNP (Double Neoprene Pad)
  - 1. Neoprene pad isolators shall be formed by two layers of ¼" to 3/8" thick ribbed or waffled neoprene, separated by a galvanized steel, stainless steel or aluminum plate. If the isolator is outdoors, the plate shall not be made of galvanized steel. These layers shall be permanently adhered together. The pads shall be sized so that they will be loaded within the manufacturer's recommended range.

Type DNP isolators shall be Mason Type WSW or approved equal.

- G. Type HSN (Hanger Spring and Neoprene)
  - 1. Vibration isolation hangers shall consist of a free standing and laterally stable steel spring and a neoprene element in series, contained within a steel housing. Spring diameters and

hanger housing lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc before contacting the housing. Hangers shall provide a means to adjust hanger elevation under load. Spring diameter shall be not less than 0.8 of the compressed height of the spring at the rated load. Spring elements shall have a minimum additional travel-to-solid equal to 50% of the rated deflection. The neoprene element shall be designed to have a 0.3" minimum static deflection. The deflection of both the spring element and the neoprene element shall be included in determining the overall deflection of Type HSN isolators.

Type HSN isolators shall be Mason Type P30N or approved equal.

- H. Type HN (Hanger Neoprene)
  - Vibration isolation hangers shall consist of a neoprene-in-shear element contained within a steel housing. A neoprene neck bushing shall be provided where the hanger rod passes through the hanger housing to prevent the rod from contacting the hanger housing. The diameter of the hole in the housing shall be sufficient to permit the hanger rod to swing through a 30° arc before contacting the hanger housing.

Type HN isolators shall be Mason Type HD or approved equal.

# 2.2 EQUIPMENT BASES

- A. Type BIB (Base Inertia Base)
  - 1. Concrete inertia bases shall be formed of stone-aggregate concrete (150 lbs./cu.ft.) and appropriate steel reinforcing cast between welded or bolted perimeter structural steel channels. Inertia bases shall be built to form a rigid base which will not twist, racks deform, deflect, or crack in any manner which would negatively affect the operation of the supported equipment or the vibration isolation mounts. Inertia bases shall be adequately sized to support basic equipment units and motors plus any associated pipe elbow supports, duct elbow supports, electrical control elements, or other components closely related and requiring resilient support in order to prevent vibration transfer to the building structure. Inertia base depth shall be at least 1/12 the longest dimension of the inertia base, but not less than 6" nor more than 12". The base foot print shall be large enough to provide stability for supported equipment. Inertia bases shall be located on the sides of the base that are parallel to the axis of rotation of the supported equipment.
  - 2. The steel frame and reinforcement shall be supplied by the vibration isolator manufacturer. Concrete may be provided by the General Contractors.

Frame and reinforcement for Type BIB bases shall be Mason Type KSL or approved equal.

- B. Type BC-1 (Base Curb)
  - 1. Curb type isolation bases shall be a prefabricated assembly consisting of an extruded aluminum frame and steel spring isolation system that fits over the roof curb and under the isolated equipment. The aluminum frame shall be sufficiently rigid to support the equipment load without detrimental twist or deflection. Spring isolators shall be selected and positioned along the curb to achieve the minimum static deflection called for in the schedule. The static deflection shall be constant around the entire periphery of the base. Springs shall be free standing, laterally stable with a diameter of not less than 0.8 times the compressed height, and have additional travel-to-solid that is at least 50% of the rated deflection. Resilient neoprene snubbers shall be provided at the corners of the base to limit the movement of the equipment under wind load to ¼".
  - 2. The isolation curb base shall be made weather tight by sealing all around the periphery with closed cell neoprene or flexible vinyl. This shall in no way inhibit the vibration isolation of the spring elements. A closed cell sponge gasket or field caulking shall be used between the equipment unit and the isolation curb base and between the isolation curb and roof curb to form a weather-tight seal.
  - 3. Each spring isolator used in the curbs shall be weather protected as described above.

4. Curb shall be designed to allow for horizontal ductwork. See drawings.

Type BC-1 vibration isolation curb bases shall be Mason Type CMAB or approved equal.

#### 2.3 RESILIENT LATERAL GUIDES

A. These units shall either be a standard product of the vibration isolation mounting manufacturer, or be custom fabricated from standard components. These units shall incorporate neoprene isolation elements similar to Type FN which are specifically designed to provide resilient lateral bracing of duct or pipe risers.

Resilient lateral guides shall be Mason Type ADA.

#### 2.4 FLEXIBLE DUCT CONNECTORS

A. Flexible duct connection shall be made from coated fabric (or leaded vinyl if called for on the drawings). The clear space between connected parts shall be a minimum of 3" and the connection shall have 5" minimum of slack material.

# 2.5 FLEXIBLE PIPE CONNECTIONS

- A. Flexible pipe connection shall be fabricated of multiple plies of nylon cord, fabric, and neoprene; and shall be vulcanized so as to become inseparable and homogeneous. Flexible connections shall be formed in a double sphere shape, and shall be able to accept compressive, elongative, transverse, and angular movements.
- B. The flexible connections shall be selected and specially fitted, if necessary, to suite the system temperature, pressure, and fluid type. In addition, suitable flexible connections should be selected which do not require rods or cables to control extension of the connector.
- C. Connectors for pipe sizes 2" or smaller shall have threaded female union couplings on each end. Larger sizes shall be fitted with metallic flange couplings.
- D. Flexible pipe connections shall be mason Industries Type BSS braided stainless steel hose with carbon steel fittings.

Double bellow isolators shall be Mason Type Safeflex

# 2.6 RESTRAINTS

- A. Snubber:
  - Snubbers shall be custom fabricated using Type FN isolators mounted to steel angle brackets. The steel angle shall be sufficiently rigid and the mounting sufficiently secure to resist excessive movement of equipment during on-off cycle.
- B. Thrust Restraints:
  - 1. Thrust restraints shall consist of a spring element in series with a neoprene pad. The unit shall be designed to have the same deflection due to thrust-generated loads as specified for the isolators supporting the equipment. The spring element shall be contained within a steel frame and be designed so it can be precompressed at the factory to allow for a maximum of ¼" movement during starting or stopping of the equipment. Allowable movement shall be field-adjustable.
  - 2. The assembly shall be furnished complete with rods and angle brackets for attachment to both the equipment and the adjacent fixed structural anchor.
  - 3. Thrust restraints shall be Mason Industries Type WB, Kinetics Noise Control Type HSR, Amber/Booth Type TRK or an equal product of the manufacturer supplying the isolators.

## 2.7 GROMMETS

A. Grommets shall either be custom made by combining a neoprene washer and sleeve, be Isogrommets as manufactured by MBIS, Inc. (Bedford Heights, Ohio), or be Series W by Barry Controls (Watertown, Mass.). Grommets shall be sized so that they will be loaded within the manufacturer's recommended load range. Grommets shall be specially formed to prevent both from directly contacting the isolator base plate.

#### 2.8 ACOUSTICAL SEALANT

A. Sealants for acoustical purposes as described in this specification shall be silicone or one of the non-setting sealants indicated below:

| Acoustical Sealant  | D.A.P  |
|---------------------|--------|
| AIS 919 or AC 20FTR | Pecora |
| Acoustical Sealant  | Tremco |
| Acoustical Sealant  | U.S.G. |

# PART 3 - EXECUTION

# 3.1 APPLICATION

- A. General:
  - 1. Refer to SECTION 2 PRODUCTS of this specification for vibration isolation devices identified on the drawings or specified herein.
  - 2. The static deflection of all isolators specified herein are the minimum acceptable deflections for the mounts under actual load. Isolators selected solely on the basis of rated deflection are not acceptable and will be disapproved.

# B. Major Equipment:

- 1. Unless otherwise shown or specified, all floor-mounted major equipment shall be set on 4" high concrete housekeeping pads. See architectural or structural drawings for details.
- 2. Types and minimum static deflections of vibration isolation devices for major equipment items shall be as scheduled on the drawings or specified hereunder.
- 3. Flexible duct connections shall be installed at all fan unit intakes, fan unit discharges, and wherever else shown on the drawings.
- 4. Flexible pipe connections shall be installed at all pipe connections to vibration-isolated equipment in the positions shown on the drawings.
- 5. Thrust restraints shall be installed on all floor-mounted fans developing 4" or more of static pressure, all suspended fans developing 2" or more static pressure, and wherever else called for on the drawings.
- 6. Snubbers shall be installed as called for on the drawings.
- C. Miscellaneous Mechanical Equipment:
  - Miscellaneous pieces of mechanical equipment such as converters, pressure reducing stations, dryers, strainers, storage tanks, condensate receiver tanks, and expansion tanks which are connected to isolated piping system shall be vibration isolated from the building structure by Type NP or Type HN isolators (selected for 0.1" static deflection) unless their position in the piping system requires a higher degree of isolation as called for under Pipe Isolation.
- D. Pipes:
  - 1. All chilled water, condenser water, heating water, drain and engine exhaust piping that is connected to vibration-isolated equipment shall be isolated from the building structure within the following limits:
    - a. Within mechanical rooms.

- b. And within 50' total pipe length of connected vibration-isolation equipment (chillers, pumps, air handling units, pressure reducing stations, etc.):
- 2. Piping shall be isolated from the building structure by means of vibration isolation mounts, resilient pipe guides, and resilient penetration sleeve/seals.
- 3. Isolators for the first three support points adjacent to connected equipment shall achieve one half the specified static deflection of the isolators supporting the connected equipment. When the required static deflection of these isolators is greater than ½" Type FSN or HSN isolators shall be used. When the required static deflection is less than or equal to ½", Type FN or HN isolators shall be used. All other pipe support isolators within the specified limits shall be either Type FN or HN achieving at least ¼" static deflection.
- 4. Where lateral support of pipe risers is required within the specified limits, this shall be accomplished by use of resilient lateral supports.
- 5. Pipes within the specified limits that penetrate the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.
- 6. Provide flexible pipe connections on all piping connected to all isolated equipment and wherever shown on the drawings.

# 3.2 INSTALLATION OF VIBRATION ISOLATION EQUIPMENT

- A. General:
  - 1. Locations of all vibration isolation devices shall be selected for ease of inspection and adjustment as well as for proper operation.
  - 2. Installation of vibration isolation equipment shall be in accordance with the manufacturer's instructions.
- B. Isolation Mounts:
  - 1. All vibration isolators shall be aligned squarely above or below mounting points of the supported equipment.
  - 2. Isolators for equipment with bases shall be located on the sides of the bases, which are parallel to equipment shaft unless this is not possible because of physical constraints.
  - 3. Locate isolators to provide stable support for equipment, without excess rocking. Consideration shall be given to the location of the center of gravity of the system and the location and spacing of the isolators. If necessary, a base with suitable footprint shall be provided to maintain stability of supported equipment, whether or not such a base is specifically called to herein.
  - 4. If a housekeeping pad is provided, the isolators shall bear on the housekeeping pad and the isolator base plates shall rest entirely on the pad.
  - 5. Hanger rods for vibration-isolated support shall be connected to structural beams or joists, not the floor slab between beam joists. Provide suitable intermediate support members as necessary.
  - 6. Vibration isolation hanger elements shall be positioned as high as possible in the hanger rod assembly, but not in contact with the building structure, and so that the hanger housing may rotate a full 360° about the rod axis without contacting any object.
  - 7. Parallel running pipes may be hung together on a trapeze, which is isolated from the building. Isolator deflections must be the greatest required by the provisions for pipe isolation for any single pipe on the trapeze. Do not mix isolated and non-isolated pipes on the same trapeze.
  - 8. Pipes, ducts and equipment shall not be supported from other pipes, ducts and equipment.
  - 9. Resiliently isolated pipes, ducts and equipment shall not come in rigid contact with the building construction or rigidly supported equipment.
  - 10. The installed and operating heights of equipment vibration-isolated with Type FSNTL isolators shall be identical. Limit stops shall be out of contact during normal operation. Adjust isolators to provide ¼" clearance between the limit stop brackets and the isolator top plate, and between the travel limit nuts and travel limit brackets.
  - 11. Adjust all leveling bolts and hanger rod bolts so that the isolated equipment is level and in proper alignment with connecting ducts or pipes.

- C. Bases:
  - 1. No equipment unit shall bear directly on vibration isolators unless its own frame is suitably rigid to span between isolators and such direct support is approved by the equipment manufacturer. This provision shall apply whether or not a base frame is called for on the schedule. In the case that a base frame is required for the unit because of the equipment manufacturer's requirements and is not specifically called for on the equipment schedule, a base frame recommended by the equipment manufacturer shall be provided at no additional expense.
  - 2. Unless otherwise indicated, there is to be a minimum operating clearance of 1" between inertia bases or steel frame bases and the floor beneath the equipment. Position isolator mounting brackets and adjust isolators so that the required clearance is maintained. The clearance space shall be checked by the Contractor to ensure that no construction debris has been left to short circuit or restrict the proper operation of the vibration isolation system.
- D. Flexible Duct Connections:
  - 1. Sheet metal ducts and plenum opening shall be squarely aligned with the fan discharge, fan intake, or adjacent duct section prior to installation of the flexible connection, so the clear length is approximately equal all the way around the perimeter. Flexible duct connections shall not be installed until this provision is met. There shall be no metal-tometal contact between connected sections, and the fabric shall not be stretched taut.
- E. Flexible Pipe Connections:
  - 1. Install flexible pipe connections in strict accordance with the manufacturer's instructions.
- F. Restraints:
  - 1. Snubbers shall be adjusted to clear the equipment base and to provide lateral restraint during on-off cycling, but be out of contact during normal operation of the equipment.
  - 2. Thrust restraints shall be attached at the centerline of thrust and symmetrically on each side of the unit. The two rods of the thrust restraint shall be axially aligned. This may require modified brackets or standoffs. The body of the thrust restraint shall not come in contact with the connected elements. Thrust restraints shall be adjusted to constrain equipment movement to the specified limit.
- G. Resilient Penetration Sleeve/Seals:
  - 1. Maintain an airtight seal around the penetrating element and prevent rigid contact between the penetrating element and the building structure. Fit the sleeve tightly to the building construction and seal airtight on both sides of the construction penetrated with acoustical sealant.
    - a. At minimum, provide resilient penetration seals at all Mechanical, Equipment and Fan Room Penetrations.

| UNIT                            | ISOLATOR<br>TYPE | MINIMUM<br>STATIC<br>DEFL.(IN.) | BASE<br>TYPE | REMARKS                                                  |
|---------------------------------|------------------|---------------------------------|--------------|----------------------------------------------------------|
| MAU                             | BC-1             | 1.5                             | BC-1         | Isolators not required if fan is<br>internally isolated. |
| Inline Fans                     | HSN              | 2                               |              |                                                          |
| Fan Coil Units                  | HSN              | 0.75                            |              |                                                          |
| Pumps (Inline)                  | HSN              | 0.75                            |              |                                                          |
| Condensing Units (Indoor Units) | FN               |                                 |              |                                                          |
| Pumps<br>(Basemount)            | BIB              | 1.5                             |              |                                                          |

#### 3.3 ISOLATOR SCHEDULE

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| Cooling Tower | FSNTL | 2.5  |  |
|---------------|-------|------|--|
| Boiler        | FN    | 0.35 |  |

# SECTION 230553 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

- 1.1 SUBMITTALS
  - A. Submit manufacturer's product data on the following:
    - 1. Plastic Pipe Markers and method of application.
    - 2. Engraved Plastic Laminate Sign.

# PART 2 – PRODUCTS

## 2.1 GENERAL

- A. Except as otherwise indicated, provide manufacturer's standard products.
- B. Where more than a single type is specified for an application, selection is Installer's option, but provide a single selection for each application.

## 2.2 PLASTIC PIPE MARKERS (TYPE A)

- A. Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, color-coded, plasticsheet pipe markers, complying with ANSI A13.1.
- B. For Pipes Less Than Six Inches (including insulation if any): Provide full-band pipe markers, extending 360° around pipe at each location, fastened by one of the following methods:
  - 1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
  - 2. Adhesive lap joint in pipe marker overlap.
  - 3. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than <sup>3</sup>/<sub>4</sub>" wide; full circle at both ends of pipe marker, tape lapped 1-½".
- C. For Pipes Six Inches and Larger (including insulation if any): Provide either full-band or strip-type markers, but not narrower than 3 x letter height, taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-½" wide; full circle at both ends of pipe marker, tape lapped 3".
- D. Lettering: Manufacturer's pre-printed wording which conforms to contract document system descriptions.
- E. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering or as a separate unit of plastic (to accommodate both directions).

# 2.3 STENCILING (TYPE B)

- A. Using a color contrasting to the surface to identify, spray or brush paint through neatly cut stencils.
- B. Lettering shall conform to wording on contract documents. Size shall be in accordance with ANSI A13.1.

# 2.4 BACKGROUND COLOR AND STENCILING (TYPE C)

A. In addition to the requirements above, paint a background color band in accordance with ANSI A13.1.

# 2.5 VALVES TAGS

- A. Brass Valve Tags: Provide manufacturer's standard 19 ga brass tag; approximately  $1-\frac{1}{2}$ " round wit  $\frac{1}{2}$ " high black filled numbers and 3/16" top hole.
  - 1. Numbers shall be sequential in accordance with schedule below.
  - 2. Provide separate numbering for each legend sequence. Provide separate sequences for the following:
    - a. Gas (GAS)
    - b. Plumbing (PLBG)
    - c. Heating Water (HTG)
    - d. All other systems (No legend)
- B. Valve Tag Fasteners: Manufacturer's standard chain (wire link or beaded type), or S-hooks.

## 2.6 VALVE SCHEDULE

- A. Provide schedule for each piping system, as defined on the drawings, and below, typewritten and reproduced on 8-½" x 11" bond paper.
- B. Tabulate valve number, piping system, system legend (as shown on tag), location of valve (room or space), and variations for identification (if any).
- C. Provide piping schematic for each system as defined below in Part 3.
- D. In addition to mounted copies, furnish extra copies for maintenance manuals as specified.
- E. Valve Schedule Frames: For each page of the valve schedule, provide a glazed frame, with screws for removable mounting on masonry walls.

## 2.7 ENGRAVED PLASTIC-LAMINATE SIGNS

- A. General: Provide engraving stock melamine plastic laminate, 1/16" thick, black with white core (letter color).
- B. Fastening:
  - 1. Screws
  - 2. Rivets
  - 3. Permanent Adhesive
- C. Lettering and Graphics:
  - 1. Coordinate names, abbreviations and other designations used in the mechanical identification work, with the corresponding designations shown, specified or scheduled in the construction documents.
  - 2. In addition, for heating or cooling units and exhaust fans, identify area served.

# PART 3 – EXECUTION

- 3.1 GENERAL
  - A. Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, install identification after completion of covering and painting.
  - B. Install identification prior to installation of acoustical ceilings and similar removable concealment.

## 3.2 DUCTWORK IDENTIFICATION

- A. General: Identify air supply, return, exhaust, intake and relief ductwork with stenciled signs and arrows, showing ductwork service and direction of flow, in black or white, whichever provides most contrast with ductwork color.
- B. Location: In each space where ductwork is exposed, or concealed only by removable ceiling system, locate signs near points where ductwork originates or continues into concealed enclosures (shaft, underground or similar concealment), and at 50' spacing along exposed runs.
- C. Access Doors: Provide stenciled or plastic laminate type signs on each duct or equipment mounted access door in ductwork and housings, indicating the purpose of the access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information.

#### 3.3 PIPING SYSTEM IDENTIFICATION

- A. General: Install pipe markers on piping of the following systems and include arrows to show normal direction of flow.
  - 1. Domestic water piping (hot, cold, tempered; 120° hot, hot water recirculating, etc.).
  - 2. Plumbing vent and sanitary (above grade) piping.
  - 3. Storm piping.
  - 4. Heating water piping (supply and return).
  - 5. Natural gas piping, (indicate pressures).
  - 6. Condenser water (supply and return).
  - 7. Refrigerant piping (suction, liquid, hot gas bypass).
  - 8. Boiler system piping (make-up, condensate, vent, chemical treatment).
  - 9. Any other piping system as indicated on the drawings, or as required to match existing.
- B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces above accessible ceilings, in accessible maintenance spaces, including chases, and above ceiling:
  - 1. Near each valve and control device.
  - 2. Near each branch, excluding short take-offs for fixtures and terminal units. Mark each pipe at branch, where there could be a question of flow pattern.
  - 3. Near locations where pipes pass through walls, floors, or ceilings, or enter non-accessible enclosures.
  - 4. Near major equipment items and other points of origination and termination.
  - 5. Spaced intermediately at maximum spacing of 50' along each piping run.
  - 6. Within 6' of access doors above otherwise non-accessible ceilings and chases.
- C. Type:
  - 1. Normally exposed to view Type A or C.
  - 2. Normally concealed from view Type B.

# 3.4 VALVE IDENTIFICATION

- A. Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory fabricated equipment units, plumbing fixtures faucets, hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.
- B. Mount framed valve schedules with piping schematics where directed by Architect.
- C. Identify each valve tagged on as-built drawings.

# 3.5 MECHANICAL EQUIPMENT IDENTIFICATION

- A. Install an engraved plastic laminate sign on or near each scheduled item of mechanical equipment.
- B. Provide engraved plastic laminate nameplate on every new piece of equipment not already provided with one in accordance with Section 23 05 02 of the specifications.
- C. Identify area served, if applicable.

# 3.6 NON-POTABLE WATER IDENTIFICATION

- A. Provide an engraved plastic laminate sign.
  - 1. Legend: "Non-Potable Water".
  - 2. Location: At each outlet of piping downstream of backflow preventer, (e.g. Boiler Room hose bibb).

# SECTION 230593 - TEST-ADJUST-BALANCE

PART 1 – GENERAL

#### 1.1 QUALITY ASSURANCE

- A. Qualification:
  - 1. Work shall be done by a firm certified by the National Environmental Balancing Bureau (NEBB), or the Associated Air Balance Council (AABC), or the firm shall have technicians certified by the "National Training Fund Sheet Metal & Air Conditioning Industry".
  - 2. The firm shall be an independent testing and balancing form specializing in testing and balancing of environmental systems.
  - 3. The firm shall have an experience record of not less than five (5) years experience in the TAB industry.
- B. Industry Standards: Comply with the following:
  - 1. HVAC Systems-Testing, Adjusting, Balancing published by Sheetmetal and Air Conditioning Contractors National Association, Inc. (SMACNA).
  - 2. Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems published by National Environmental Balancing Bureau. (NEBB).
  - 3. ASHRAE Systems Handbook. Testing, Adjusting and Balancing.
- C. Registration: Work shall be done under the supervision of a professional engineer registered in Colorado. Engineer shall be available for all meetings and interpretation of all materials in the report.
- D. Pre-qualification of TAB Contractor.
  - 1. The firm must have experience and qualifications satisfactory to the consulting mechanical engineer and must be accepted by him prior to bidding.
  - 2. Firms desiring approval to provide work under this section shall submit a booklet indicating procedures and data forms that they would use in the performance of the work.
  - 3. Submittals shall be in accordance with Section 200101.
  - 4. Only firms which have been approved by the mechanical engineer prior to bid date may provide work under this section.

# PART 2 – PRODUCTS

2.1 PRODUCTS (Not applicable)

# PART 3 – EXECUTION

#### 3.1 GENERAL

- A. Sequence work to commence after completion of system and start-up procedures and schedule completion of work before Substantial Completion of Project.
- B. Examine the installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned and is operable.
- C. Notify the Contractor in writing of conditions detrimental to the proper completion of the test-adjustbalance work.
  - 1. Do not proceed with the work until unsatisfactory conditions have been corrected.
  - 2. Provide Engineer/Architect with a copy of the notification.

- D. Adjust air flows and heating water systems to within 10% of values shown. Adjust chilled water systems to within 5% of values shown. If design flows cannot be obtained within specified limits the Balancing Contractor will perform the following (at the minimum):
  - 1. Measure and record major pressure drops in the system.
  - 2. Consult with the Engineer and Installer as required.
  - 3. Upon receiving written directions to proceed and after any corrections are performed, rebalance affected portion of system.
- E. Optimization: Work closely with the Section 23 09 00 contractor to optimize setpoints.
  - 1. Establish the minimum air static pressure or water differential pressure for variable or bypass flow system.
  - 2. Establish the position of minimum outside air dampers, damper/valve and sequencing relays.
- F. Calibration: Be responsible for calibration of flow measurement devices used as input to the temperature control system. All air systems flow measurement stations including VAV terminals shall be calibrated against a pitot tube traverse or air diffuser capture hood. Balancing contractor shall assure accuracy of all flow measurement devices or shall report on their failure to be accurate.
- G. Patch holes in insulation, ductwork and housings, which have been cut or drilled for test purposes, in a manner recommended by the original Installer.
- H. Make all final readings for each system at the same time, and after all adjustments have been made.
- I. Mark equipment settings, including damper control positions, balancing cocks, circuit setters, valve indicators, fan speed control settings and similar controls and devices, to show final settings at completion of test-adjust-balance work.
  - 1. Mark with paint or other suitable permanent identification material.
- J. Check all new thermal overloads.
  - 1. Identify improperly protected equipment in report.

#### 3.2 AIR SYSTEMS

- A. Scope: All air systems are to be balanced.
- B. Before any adjustments are made, check for:
  - 1. Dirty filters, coils, or air intakes
  - 2. Duct leakage
  - 3. Filter leakage
  - 4. Damper leakage, or blockage
  - 5. Equipment vibrations
  - 6. Correct damper operation
- C. Simulate a pressure drop across filters equal to that when 50% loaded with dust.
  - 1. Check fan motor amps with clean filters and simulated loaded filters, and report.
- D. Procedure:
  - 1. Measure and report the following for all supply, return, exhaust, and outside air systems:
    - a. Individual air inlets and outlets.
    - b. Pitot traverses of main supply, return, exhaust and outside air ducts.
    - c. Rotating valve or velocity grid traverse of coils or filters.
    - d. Plot operating point on fan curve. Include compensation for effects of altitude and inlet vanes.

- 2. Above measurements shall be made with system in normal, full load condition.
  - a. Systems with economizers shall be measured at minimum outside air and 100% outside air.
  - b. Systems with 100% outside air capability or evaporative cooling sections shall be measured at maximum outside air.
  - c. VAV systems shall be measured at the zone level at maximum air condition, and at the main at the system diversity condition.
- 3. Make main duct traverses or coil/filter traverses and report operation at all other operating conditions (as applicable).
  - a. Economizer operation
  - b. Unoccupied mode
  - c. Purge mode
  - d. All VAV terminals driven to maximum position
- 4. Set fan speed such that under no condition will the motor exceed the service factor rating when operating in any of the above possible modes.
- 5. Measure fan motor amps in each of the above possible operating modes (clean filters).
- 6. Adjust Air Systems to provided proper air pressure relationships as shown by relative air quantities or as indicated on the drawings.
- E. Adjust distribution system for uniform space temperatures free from objectionable drafts and noise.
  - 1. Division 233300 to provide orifice plates or dampers where required.
- F. Exchange sheaves and belts as required to adjust the rpm of all fans so they handle specified air quantity.
- G. Set minimum outside air quantities.

# 3.3 DOMESTIC WATER SYSTEM

- A. Scope: Balance all domestic hot water and hot water re-circulation systems.
- B. Before any adjustments are made:
  - 1. Check temperature control device operation (mixing valves, external temperature control devices, etc.)
  - 2. Check rotation of pumps.
  - 3. Adjust pressure reducing valves.
  - 4. Verify proper operation of ASME pressure and temperature relief valves.
- C. Using flow meters, adjust the quantity of water circulated by each pump and the flow in each branch of the hot water re-circulation systems.

#### 3.4 HYDRONIC SYSTEMS

- A. Scope: Balance all hydronic systems.
- B. Before any adjustments are made:
  - 1. Check temperature control valve operation.
  - 2. Check pump rotation.
  - 3. Adjust pressure reducing valve.
  - 4. Remove any roughing strainer screens in systems.
- C. Using system flow meters, adjust the quantity of fluid handled by each pump and supplied to each coil, piece of radiation, heat exchanger, cross-over bridge, bypass, etc., to meet design requirements.

b.

# D. Procedure:

- 1. Measure and report all hydronic and domestic water recirculation systems by all of the below means which are applicable.
  - a. System, pump, branch, or terminal flow measuring stations.
    - Terminal or heat exchanger pressure drop, compare to submittal data.
  - c. Plot operating point on pump curve. Include compensation for effects of temperature, viscosity and density.
- 2. Above measurements to be made and reported at full heating/cooling load.
  - a. For 3-way valve terminals/heat exchangers set bypass flow to equal coil flow.
  - b. For primary/secondary systems, set crossover/bridle to have constant flow at all conditions.

#### 3.5 DETAILED REQUIREMENTS

- A. Measure, adjust and report the following:
  - 1. Fans:
    - a. Inlet and outlet pressure
    - b. Air flow
    - c. Fan speed
    - d. Motor amps and KW
  - 2. Ductwork Systems:
    - a. Air flow at each inlet and outlet.
    - b. Blade angles at all adjustable diffusers.
    - c. Filter pressure drop.
    - d. Outside air percentage at minimum and maximum setting.
    - e. Air flow at supply, return, outside air and exhaust mains to determine total air flow.
  - 3. Coils:
    - a. Air flow.
    - b. Inlet and outlet air static pressure.
    - c. Inlet and outlet air temperature.
    - d. Water flow.
    - e. Inlet and outlet water pressure.
    - f. Inlet and outlet water temperature.
    - g. Kw draw on electric coils.
  - 4. Pumps:
    - a. Water flow
    - b. Inlet and outlet pressure
    - c. Motor amps and KW
  - 5. Heating and Domestic Hot Water Boiler(s): Check at full fire.
    - a. Inlet and outlet water temperatures
    - b. Water flow
    - c. Stack temperatures
    - d. Gas pressure and cubic feet of gas per hour Percent CO<sub>2</sub> and O<sub>2</sub>
    - e. Combustion efficiency

- f. If boiler is equipped for variable firing rates, include data for a. through e. for maximum and minimum firing rates.
- g. Manufacturers start-up report may be substituted if all above measurements are included.
- 6. Cabinet Heaters, Unit Heaters:
  - a. Entering air temperature
  - b. Leaving air temperature
  - c. Inlet and outlet water temperature
  - d. Water flow
- 7. Air-Cooled Condensing Units:
  - a. Ambient temperature
  - b. Suction and discharge pressure
  - c. Oil pressure
  - d. Compressor amps and KW
  - e. Fan amps and KW
- 8. Packaged Air Conditioning Units:
  - a. Perform tests for individual components present in units in accordance with specific requirements above.
  - b. At full heat: (Check at minimum outside air):
    - 1) EAT
    - 2) LAT
  - c. At full cooling: (Check at minimum outside air):
    - 1) EAT (DB/WB)
    - 2) LAT (DB/WB)
    - 3) Ambient temperature
    - 4) Suction and discharge pressures
    - 5) Oil pressure
    - 6) Compressor amps and KW
- 9. Cooling tower:
  - a. Inlet air wet bulb
  - b. Entering and leaving water temperatures
  - c. Water flow
  - d. Fan amps and voltage

# 3.6 REPORT

- A. Provide a general information sheet listing:
  - 1. Instruments used:
    - a. Most recent calibration date.
  - 2. Method of balancing.
  - 3. Altitude correction.
  - 4. Manufacturer's performance data for all air devices used.
- B. Provide data sheets for all equipment, including motors and drives, listing:
  - 1. Make
  - 2. Size
  - 3. Serial number

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- 4. Capacity Rating
- 5. Amperage
- 6. Voltage input
- 7. Thermal heater size for each motor
- 8. Operating speed of driver and driven devices
- 9. Any additional pertinent performance data
- C. Include design and final values for all items listed in Detailed Requirements, and totals for each system.
- D. Provide data sheets showing:
  - 1. Air flow at each inlet and outlet
  - 2. Instrument used
  - 3. Velocity reading
  - 4. Manufacturer's free area factors
- E. Provide recap sheet with explanation for each device not meeting specified performance.
- F. Provide a set of prints with equipment, inlets and outlets marked to correspond to data sheets.

# 3.7 VERIFICATION

- A. Upon completion of the TAB work the balancing firm shall demonstrate fluid flow quantities indicated in a preliminary TAB report.
  - 1. The TAB representative shall be a member of the same team used during the original testing.
  - 2. Equipment used during the random testing shall be the same equipment used during the original testing.
  - 3. The system or equipment being verified shall be in the same operating mode as during the original TAB test.
  - 4. Up to 10% of the air readings shall be re-tested. Ninety percent (90%) of the re-tested readings must be within tolerances of the specifications.
  - 5. Up to 10% of the balanced heating hydronic component readings shall be re-tested. Ninety percent (90%) of the re-tested readings must be within tolerances of the specifications.
  - 6. Up to 20% of the balanced chilled water component readings shall be re-tested. Ninety percent (90%) of the re-tested readings must be within tolerances of the specifications.
  - 7. Whenever system verifications do not meet these specifications the entire system shall be re-balanced and rechecked.

# 3.8 COMMISSIONING

- A. Reference Section 23 08 00 for commissioning scope.
- B. Provide all necessary personnel, tools and equipment to comply with the commissioning scope.

END OF SECTION 230593

# SECTION 230700 - MECHANICAL INSULATION

#### PART 1 – GENERAL

#### 1.1 SUBMITTALS

- A. Submit manufacturer's product data on the following:
  - 1. Insulation.
  - 2. Jackets, coatings and protective finishes.
  - 3. Sealers, mastics and adhesives.
  - 4. Fitting covers.
  - 5. Manufacturer's installation details for fire rated duct wrap.
  - 6. Low-Emitting Adhesives and Sealants EQc4.1 requirements for LEED submittals.

# 1.2 FLAME AND SMOKE RATINGS

- A. Provide insulation tested on a composite basis (insulation, jacket, covering, sealer, mastic and adhesive) complying with the following:
  - 1. Flame Spread: 25 or Less
  - 2. Smoke Developed: 50 or Less
  - 3. Method: ASTM E84 (NFPA 255)

#### 1.3 PRODUCT DELIVERY

A. Deliver insulation products in factory containers bearing manufacturer's label showing fire hazard rating, density and thickness.

# 1.4 DEFINITIONS

- A. Exposed Location: Located in mechanical rooms or other areas exposed to view.
- B. Concealed Location: Located in pipe chases, furred spaces, attics, crawl-spaces, above suspended ceilings, or other locations not exposed to view.

#### 1.5 STANDARDS

A. Comply with the latest edition of National Commercial and Industrial Insulation Standards.

# PART 2 – PRODUCTS

#### 2.1 PIPE INSULATION

- A. Manufacturers:
  - 1. Design Basis: Johns-Manville
  - 2. Other Acceptable Manufacturers:
    - a. Armstrong
    - b. Foster
    - c. Owens-Corning
    - d. Knauf
    - e. Nomaco
    - f. Imcoa
    - g. Pittsburgh Corning
    - h. Cell-U-Foam

- B. Materials:
  - 1. Fiberglass Pipe Insulation: Johns-Manville Micro-Lok heavy density pipe insulation with AP-T jacket.
  - 2. Fiberglass Pipe Fitting Insulation: Johns-Manville "Zeston" fitting covers with factory-cut fiberglass insulation insert.
  - 3. Flexible Unicellular Pipe Insulation: Armstrong Armaflex, II or Therma-cel By Nomaco.
  - 4. Cellular glass with vapor barrier coating: Pittsburgh Corning.
  - 5. Rigid Closed Cell Insulation: Dow Trymer 2000 (not for use indoors).
- C. Thickness: (Thickness listed below are minimum required. Provide thickness required by Local Building or Energy Codes).
  - 1. Service (Domestic) Water Piping:
    - a. Hot:
      - 1) 2" and Smaller: 1"
      - 2) 2-1/2" and Larger: 1 1/2":
      - 3) Runouts up to 2" and 10 feet long:  $\frac{1}{2}$ "
    - b. Cold: 1"
  - 2. Heating Water, Not Over 200°F:
    - a. Size  $1\frac{1}{2}$ " and smaller:  $1\frac{1}{2}$ "
    - b. Size over 1 ½": 2"
    - c. Runouts up to 1" and 4 feet long, to terminal units: 1/2"
  - 3. Condenser Water:
    - a. Size 1" and smaller: 1"
    - b. Size over 1": 1-½"
    - c. Runouts up to 1" and 4 feet long, to terminal units: 1/2"
  - 4. Storm Water:
    - a. All Sizes: 1"
  - 5. Refrigerant Suction and Hot gas Bypass Lines:
    - a. Size 2-1/8" and smaller: 1/2"
    - b. Size 2-5/8" and larger: <sup>3</sup>/<sub>4</sub>"
  - 6. Refrigerant Liquid Lines:
    - a. All Sizes: <sup>1</sup>/<sub>2</sub>" (1" for fiberglass)
  - 7. All Heat Traced Piping:
    - a. Size 2" and smaller: 1"
    - b. Size 2<sup>1</sup>/<sub>2</sub>" and larger: 2"
  - 8. Condensate Drain Piping:
    - a. All sized: 1/2" (1" for fiberglass)
- D. Application: Unless otherwise indicated, use the following:
  - 1. Inside, above ground: Fiberglass.
  - 2. Inside exposed: Fiberglass with PVC jacket (jacket not required in mechanical rooms).
  - 3. Outside, protected: Fiberglass.
  - 4. Outside, exposed to weather: Rigid closed cell with aluminum jacket.

- 5. Below grade or slab:
  - a. Pipe size 1½" and less: Single piece of flexible closed cell insulation slipped over soft annealed copper tube without slitting insulation.
  - b. Pipe size 2" and larger: Rigid closed cell insulation with shrink fit jacket.
- 6. PVC: 1½" thick fiberglass (duct) insulation, or 1" heavy density pipe insulation installation to meet ASTM E84 (NFPA 255) flame spread and smoke developed ratings.

#### 2.2 DUCT INSULATION

- A. Manufacturer:
  - 1. Design Basis: Johns Manville
  - 2. Other Acceptable Manufacturers:
    - a. Certainteed
    - b. Knauf
    - c. Owens-Corning
- B. Materials:
  - 1. Flexible Faced fiberglass Ductwork Insulation: Johns-Manville Microlite, with FSK factory applied foil-scrim-kraft facing.
  - 2. Rigid Fiberglass Ductwork Insulation: Johns-Manville 800 Series, Spin-Glas Type 814, 3 lb. Density rigid board with FSK jacket.
  - 3. Flexible Plain Fiberglass Ductwork Insulation: Johns-Manville Microlite .75 lb/cu. Ft. unfaced.
  - 4. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles, and similar accessories as recommended by the insulation manufacturer for the applications indicated.
  - 5. Cellular glass: Pittsburgh Corning with vapor barrier.
- C. Application:
  - 1. Insulate all concealed unlined supply duct with 1-½" thick flexible, faced fiberglass.
  - 2. Insulate all exposed unlined ductwork, transporting outside air with 1" thick rigid fiberglass.
  - 3. Insulate all concealed unlined ductwork, transporting outside air with 1<sup>1</sup>/<sub>2</sub>" thick flexible fiberglass.
  - 4. Insulate all exposed unlined return air duct with 1" thick rigid fiberglass.
  - 5. Insulate all concealed unlined return air ductwork with 1<sup>1</sup>/<sub>2</sub>" flexible fiberglass, with or without facing.
  - 6. Where energy codes require additional insulation over that listed above, provide insulation in accordance with those codes.
  - 7. Insulate all accessories and components (fire dampers, silencers, air valves, etc) of the duct systems noted above as requiring insulation. Where lined systems contain components that cannot be lined or have not been provided with liner, insulate them. That insulation shall overlap the lined portion of the system by at least 12 inches.
- D. Duct Liner:
  - 1. See Section 23 31 13, for duct liner requirements. Supply, return and outside air ductwork that is not lined is to be externally insulated.

# 2.3 OUTDOOR DUCT INSULATION

A. Manufacturers:

2.

- 1. Design Basis: Armstrong
  - Other Acceptable Manufacturers:
    - a. Johns-Manville
    - b. Nomaco

- B. Materials:
  - 1. Model: Armaflex
    - a. Description: Flexible, cellular, elastomeric foam.
    - b. Form: Sheet
  - 2. Paint: Armaflex Finish
    - a. Description: White vinyl lacquer. If duct is visible from the ground, contractor must first coordinate color of vinyl lacquer with Architect. Submit color chart to Architect for his review.
  - 3. Adhesive: Armstrong 520.
  - 4. Cellular glass: Pittsburgh Corning with vapor barrier.
- C. Application:
  - 1. All outdoor supply, return, and transfer air ducts that are specified with acoustical duct lining shall also be insulated with one layer of one inch thick sheet on the exterior.
  - 2. All outdoor supply, return, and transfer air ducts that are not specified to have acoustical lining shall be insulated with two layers of one inch thick sheet on the exterior.

#### 2.4 EQUIPMENT INSULATION

- A. Manufacturer:
  - 1. Design Basis: Johns Manville
  - 2. Other Acceptable Manufacturers:
    - a. Armstrong
    - b. Certainteed
    - c. Owens-Corning
    - d. Knauf
    - e. Pittsburgh Corning

#### B. Materials:

1. Model: Pipe and tank insulation.

Description: Flexible board type insulation. 3 PCF glass fiber insulation with all purpose jacketing. Maximum thermal conductivity .32 BTU-IN/(hr-FT<sup>2</sup>-<sup>o</sup>F) at 150<sup>o</sup>F. Glass fibers oriented such that insulation will conform to rounded shapes while maintaining high compressive strength.

- Model: Johns-Manville 800 series, spin glass type 814.
   Description: 3 PCT density rigid glass fiberboard, with all purpose jacketing. Maximum thermal conductivity .27 BTU-IN/hr-FT<sup>2</sup>--°F).
- Jacketing Material: PVC or aluminum jacketing material, except as otherwise indicated. Seal all joints.
- 4. Fiberglass: Johns-Manville Micro-Lok 850 insulation with APT jacket.
- 5. Flexible Unicellular Insulation: Armstrong Armacell sheet form.
- 6. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape, corner angles, anchors, stud pins, metal covers, adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

# PART 3 - EXECUTION

# 3.1 GENERAL

A. Verify acceptability of all materials which are to be used in air plenums (above ceiling, etc.). Materials must meet all requirements of Local Building Code and Authority having jurisdiction.

# 3.2 PIPE INSULATION

- A. Insulate the following:
  - 1. Domestic hot water piping.
  - 2. Domestic cold water piping above ground and under slab.
  - 3. Heating piping.
  - 4. Condenser water piping.
  - 5. Roof drain bodies and all horizontal storm water piping.
  - 6. Refrigerant lines.
  - 7. Condensate drain piping.
  - 8. Heat traced piping

# B. Installation:

- 1. Install insulation on pipe system subsequent to testing and acceptance of tests.
- 2. Install insulation materials with smooth and even surfaces.
  - a. Insulate each continuous run of piping with full length units of insulation, with a single cut piece to complete the run.
  - b. Do not use cut pieces or scraps abutting each other.
- 3. Clean and dry pipe surfaces prior to insulating.
  - a. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.
- 4. Extend piping insulation without interruption through pipe clamps, hangers, walls, floors and similar piping penetrations, except where otherwise indicated.
- 5. Install protective metal shields and saddles where needed to prevent compression of insulation. Refer to Section 23 05 29.
- 6. Except as noted, cover valves, flanges, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run.
  - a. Install factory-molded, pre-cut or job-fabricated units (at Installer's option), except where a specific form or type is indicated.
  - b. Do not cover:
    - 1) Valve operators.
  - c. Provide removable access for:
    - 1) Strainers.
    - 2) Other components requiring access for service.
- 7. Mark location of unions and flanges covered by insulation with permanent paint or ink, or approved label.
- 8. Maintain integrity of vapor-barrier jackets on insulation of cold pipes and storm drainage piping, and protect to prevent puncture or other damage.
- 9. Insulate between pipe and pipe saddles. Provide suitable saddles.
- 10. Seal ends of sections with vapor barrier cement to crate moisture dams at:
  - a. 21 ft. intervals.
  - b. Valves and fittings.

- c. All hangers and supports.
- 11. On underground pipe insulation, install unicellular insulation on pipe without slitting insulation.
  - a. Seal all transverse joints with adhesive.
- 12. Replace existing insulation removed or damaged because of work of this project.
- 13. Insulate new pipes and replace insulation on existing pipes to remain where insulation was removed or damaged by demolition or revisions.
- 14. Do not insulate basket access flange of flanged strainers.
- 15. Do not insulate steam traps.
- 16. Insulate between fingers of spiders in alignment guides.
- 17. Insulate between pipe and pipe slide.
- 18. Perform all work in a neat and workmanlike manner. Poor work (as determined by Architect or Engineer) will be cause for rejection.
- 19. Insulate all acid waste/vent pipe in return air plenums with Armstrong AP Armaflex.
- 20. Provide PVC jacket for all exposed, insulated piping within food service areas.

### 3.3 OUTDOOR PIPE INSULATION

A. Install rigid closed cell insulation with butt joints of half pipe sections staggered. Insulation shall be held in place with strapping tape. Install aluminum jacket with all joints lapped to shed water.
 Apply a bead of silicone sealant at all transverse and longitudinal seams. Secure with aluminum bands, minimum of 2 per jacket section.

#### 3.4 DUCTWORK INSULATION

- A. Install insulation materials with smooth and even surfaces.
- B. Clean and dry ductwork prior to insulating.
  - 1. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- C. Extend ductwork insulation without interruption through walls, floors, and similar ductwork penetrations, except where otherwise indicated.
- D. Except as otherwise indicated, do not insulate lined ducts. However, extend duct insulation 12" beyond start of lining where lined ductwork meets insulated ductwork.
- E. Maintain integrity of vapor-barrier on insulation of ducts carrying cold air, and protect it to prevent puncture and other damage.
- F. For Outdoor Insulation:
  - 1. Stagger joints on multilayer applications.
  - 2. Locate joints at sides of ducts whenever possible.
  - 3. Use 520 adhesive to attach insulation.
    - a. Use full coverage.
  - 4. Seal all seams and joints with adhesive.
  - 5. Maintain full thickness at standing seams and flanges by additional layer(s).
  - 6. Cover flexible connections.
  - 7. Extend covering to inside face of outside wall.
  - 8. Finish with two coats of Armaflex finish.

# 3.5 EQUIPMENT INSULATION

- A. Install insulation materials with smooth and even surfaces and on clean and dry surfaces.
  - 1. Re-do poorly fitted joints.
  - 2. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship.
- B. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.
- C. Apply insulation using the staggered joint method for both single and double layer construction, where feasible.
  - 1. Apply each layer of insulation separately.
- D. Do not insulate handholes, cleanouts, ASME stamp and manufacturer's nameplate.
  - 1. Provide neatly beveled edge at interruptions of insulation.
- E. Condenser Water Pumps:
  - 1. Do not insulate. Provide drain pan and drain to collect condensate formed on pump body. Pipe drain line to nearest floor drain and provide air gap.
- F. Hot Equipment (Above Ambient Temperature):
  - 1. Includes hot and heating water as well as steam equipment such as air release tanks, air separators, expansion tanks, flash tanks, vessels etc.
  - 2. Insulate with 3" thick fiberglass.
  - 3. Do not apply insulation to equipment while hot.
- G. Domestic Water Tanks:
  - 1. Insulate domestic hot water tanks with 2 inches of pipe and tank insulation of 1½ inches of rigid fiber glass board (if not originally insulated from the factory).
- H. Cold Equipment (At or below ambient equipment):
  - 1. Includes chilled, domestic cold, condenser water system equipment such as air release tanks, air separators, expansion tanks, flash tanks, vessels, etc.
  - 2. Insulate air release tanks (air separators) with 2 inches of pipe and tank insulation or 1<sup>1</sup>/<sub>2</sub> inches of rigid fiber glass board.

#### 3.6 FIRE RATED DUCT WRAP

- A. Remove dirt and dust and clean all duct surfaces.
- B. Install per manufacturers instructions and referenced standards. Where pins are required they shall be tack welded to duct.
- C. Repair any damage in accordance with manufacturer's instruction.

#### 3.7 PROTECTION AND REPLACEMENT

- A. Replace damaged insulation which cannot be repaired satisfactorily. Including units with vapor barrier damage and moisture saturation.
- B. Protection: The insulation installer shall advise the Contractor of required protection for the insulation work during the remainder of the construction period, to avoid damage and deterioration.

END OF SECTION 230700

# SECTION 23 23 00 - REFRIGERANT PIPING

# PART 1 - GENERAL

# 1.1 QUALITY ASSURANCE

- A. Installer: A firm with at least five years of successful installation experience on projects with refrigerant piping similar to that required for this project.
- 1.2 REGULATORY/REQUIREMENTS [Spec Writer: Edit Accordingly]
  - A. Comply with applicable requirements of the Clean Air Act, State of Colorado and City and County of Denver Regulations concerning handling of refrigerants.

# PART 2 - PRODUCTS

#### 2.1 REFRIGERANT PIPING

- A. Type ACR copper tube with wrought copper fittings.
- B. End Caps:
  - 1. Provide factory applied plastic end caps on each length of pipe and tube.
  - 2. Maintain end caps through shipping, storage and handling as required to prevent pipe end damage and eliminate dirt and moisture from inside of pipe and tube.

# 2.2 SHUT-OFF VALVES

- A. Manufacturers:
  - 1. Design Basis: Henry
  - 2. Other Acceptable Manufacturers:
    - a. Mueller
    - b. Superior
    - c. Imperial
- B. Size 7/8 Inch and Smaller:
  - 1. Model: Series 600.
  - 2. Type: Pack-less diaphragm.
  - 3. Material: Forged bronze.
  - 4. Flow: Non-directional.
  - 5. Servicing: Diaphragm changeable under line pressure.
- C. Size 1-1/8 Inch and Larger:
  - 1. Model: Series 200.
  - 2. Type: Wing cap, back seating.
  - 3. Material: Bronze.

# 2.3 FLEXIBLE PIPE CONNECTORS

- A. Manufacturers:
  - 1. Design Basis: Mason
  - 2. Other Acceptable Manufacturers:

# REFRIGERANT PIPING

- a. Metraflex
- b. Flexonics
- B. Braided bronze with copper tube ends, compatible with refrigerant type for system
- C. Flexible connector shall be line size or connection size, whichever is larger.

# 2.4 REFRIGERATION SPECIALTIES

- A. Filter Drier:
  - 1. Conform to ARI Standard 710.
  - 2. Sizes ½" and larger interchangeable core, full flow.
  - 3. Sizes smaller than <sup>1</sup>/<sub>2</sub>" sealed type.
  - 4. Minimum burst pressure 1500 psig.
- B. Sight Glass:
  - 1. Double port moisture indicating, reversible color indicator.
  - 2. Removable sight glass and moisture indicating element.
  - 3. Furnish with a protective cover.
- C. Expansion Valve:
  - 1. Thermostatic type, diaphragm or bellows operated.
  - 2. External superheat adjustment factory set for 10°F superheat (adjustable).
  - 3. Compatible with refrigerant type for the project.
  - 4. Pressure rated per project requirements.
  - 5. Power elements and valve size shall be as recommended by the manufacturer, for the service intended.
- D. Solenoid Valve:
  - 1. Provide solenoid valve for systems 25 tons and larger.
  - 2. Compatible with refrigerant type for the project.
  - 3. Valve shall fail in closed position (power open).
- E. Acceptable Manufacturers:
  - 1. Alco
  - 2. Sporlen

# PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Run piping level or plumb, except slope gas piping to compressor with a minimum number of elbows.
- B. Provide oil traps at bottom of suction risers. Size risers for proper oil return.
- C. Size lines for total pressure drop not to exceed 2°F saturation temperature.
- D. Provide necessary flexibility for vibration and expansion with offsets and loops, not expansion joints.
- E. Provide flexible connectors at all unit connections.

- F. Replace air in pipe with dry nitrogen to prevent corrosion during soldering.
- G. Install valves, sight glasses, filter-driers, and accessories, furnished by equipment supplier, but not factory installed.
- H. Insulate all underground refrigerant lines with ½" flexible foam.
  - 1. Use un-slit covering.
  - 2. Carefully cement all joints.

# 3.2 HANGERS

- A. For insulated piping, provide hangers of size to fit outside insulation.
- B. For non-insulated piping, provide hangers with elastomer insert to prevent damage to piping from vibration.

# 3.3 TESTING AND DEHYDRATION

- A. Use the following procedure to test and hydrate the systems:
  - 1. Isolate any elements which would be damaged by test pressures.
  - 2. Test system with trace gas using an appropriate leak detector.
  - 3. Repair or replace leaking elements of system and re-test.
  - 4. After system has been proven to be free of leaks, evacuate it with a high efficiency vacuum pump to 2.5 mm of mercury absolute.
  - 5. Allow the system to stand under vacuum for 24 hours.
    - a. Then, if a vacuum of 2.5 mm can be drawn within 30 minutes, the system shall be considered dry.
    - b. If not, the procedure shall be repeated.
  - 6. Break the final vacuum by charging with the correct refrigerant.

END OF SECTION

SECTION 233113 - DUCTWORK

PART 1 – GENERAL

#### 1.1 INDUSTRY STANDARDS

- A. Construct ductwork to meet all functional criteria defined in Section 11 of the 2005. SMACNA "HVAC Duct Construction Standards, Metal and Flexible", Third Edition. Comply with SMACNA recommendations for fabrication, construction and details, and installation procedures, except as otherwise indicated.
- B. Comply with American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), except as otherwise indicated.
- C. Comply with SMACNA "HVAC Air Duct Leakage Test Manual" for testing of duct systems.

# 1.2 SUBMITTALS

- A. Detailed ductwork shop drawings, which include sizes, layouts, and pressure classifications, must be properly submitted. Any ductwork installed without prior written approval by the engineer of record shall be replaced at the expense of the contractor.
- B. Shop Drawings: Submit shop drawings for:
  - 1. Transition elbows.
  - 2. Seal and reinforcing schedule for all ductwork fabrication types.
  - 3. Turning vane and turning vane installation.
- C. Product Data: Submit manufacturer's product data on the following:
  - 1. Duct lining.
  - 2. Duct lining adhesive.

# PART 2 – PRODUCTS

#### 2.1 DUCTWORK MATERIALS

- A. All interior ducts shall be constructed with G-90 or better galvanized steel (ASTM A653/653M) LFQ, chem treat. Exterior ductwork or duct exposed to high humidity conditions (i.e. kitchen exhausts) shall also be G-90 or better galvanized steel LFP, chem treat.
- B. Underground Ductwork: All ductwork indicated as "below grade" shall be unlined, uninsulated, completely concrete encased.
  - 1. Provide temporary internal bracing if required during placement of concrete. Remove after concrete has set.
  - 2. Straight runs may be round or rectangular at contractor's option. However, duct "friction factor" and velocity shall be equal or less than that shown on drawings at rated cfm flow rate.
- C. Stainless steel duct shall be fabricated from lock forming grade, 300 series, ASTM-Al67, No. 4 general purpose finish. Protect finish with mill applied adhesive protective plastic/paper throughout construction.
- D. Aluminum duct shall be fabricated from lock forming grade, ally 3003-HI4, ASTM B209. Reinforcing angles, bars, tie rods, and other structural members shall be alloy 6061-T6. Hangers shall be 6061-T6 aluminum, or galvanized or painted steel with a dielectric isolation pad between the dissimilar metals.
- E. PVC coated ductwork shall be fabricated from galvanized steel, cleaned and primed with a baked on PVC coating. PVC coating shall be minimum 0.035 lbs./Sq. Ft. at 5 Mills, 90 units a scale shore

durometer, flame spread rating 25, smoke developed 50, UL 181, Class I duct. Provide compatible touch up paint to repair damage.

F. Ungalvanized carbon steel shall be lockforming grade, hot rolled steel conforming to ASTM A366 or A619.

#### 2.2 RECTANGULAR DUCT

- A. Construct rectangular ductwork to meet all functional criteria defined in Section 11, of the SMACNA "HVAC Duct Construction Standards Metal and Flexible" 2005 Edition. All ductwork must comply with all local, state and federal code requirements.
- B. Where the standard allows the choice of external reinforcing or internal tie rods, only the external reinforcing options shall be used.
- C. Pittsburgh lock shall be used on all longitudinal seams. All longitudinal seams will be sealed with mastic sealant. Snaplock is not acceptable.
- D. Ductmate or W.D.C.I. proprietary duct connection systems will be accepted. Duct constructed using these systems will refer to the manufacturers guidelines for sheet gauge, intermediate reinforcement size and spacing, and joint reinforcements.
- E. Formed on flanges (T.D.C./T.D.F./T-25A/T-25B) shall be constructed as SMACNA T-25 flanges, whose limits are defined on Page 2.76 2005 SMACNA Manual, Third Edition. No other construction pertaining to formed on flanges, will be accepted. Formed on flanges shall be accepted for use on ductwork 42" wide or less, 2" static (positive) or less and must include the use of corners, bolts and cleat.
- F. Ductmate type systems that use a butyl Rubber Gasket which meets Mil-C 18969B, Type II Class B, TT-C-1796 A, Type II Class B, and TTS-S-001657 must also pass UL-723. This material, in addition to the above, shall not contain vegetable oils, fish oils, or any other type vehicle that will support fungal and/or bacterial growth (as defined in 21CFR 177, 1210 closures with sealing gaskets for food containers).
- G. Aluminum duct shall be fabricated using the aluminum thickness equivalence table in the standard. Simply increasing the thickness by two gauges is not acceptable.
- H. Fittings shall be constructed and reinforced as ductwork according to the longest span.

#### 2.3 ROUND AND OVAL DUCT

- A. Round and oval duct shall be galvanized steel, constructed in accordance with Section 11 of the 2005 SMACNA "Duct Construction Standards, Metal and Flexible", except as noted.
  - 1. Lighter gauge factory made duct with an Intermediate standing rod may be used. Submit product data sustaining the equivalency of such duct into SMACNA standard duct.
- B. Minimum duct gauge shall be 26 gauge.
- C. Round ductwork shall be spiral lock seam construction only. Longitudinal seam duct is not acceptable. Gauges shall be in accordance with SMACNA Duct Construction Standard and fittings in accordance with SMACNA Duct Construction Standard, except as noted:
  - 1. Joints 0"-20" diameter, interior slip coupling beaded at center, fastened to duct with sealing compound applied continuously around joint before assembling and after fastening. Wrap joints with 3-inch wide duct tape.
  - 2. Joints 21"-72" diameter, use 3 piece, gasketed, flanged joints consisting of 2 internal flanges (with integral mastic sealant) split to accommodate minor differences in duct diameter, and one external closure band designed to compress gasketing between internal flanges. Example: Ductmate Spiralmate or equal.
  - Joints 73" diameter and up, use companion angle flanged joints only as defined on page 3-6 of the SMACNA Manual. Refer to manual for proper sizing and construction details. Ductwall to be welded longitudinal seams.

- D. Fittings shall be continuously welded, standing seam, or spot welded and sealed. Metal thickness and reinforcing shall be equivalent to the requirements of the largest span.
  - 1. All elbows greater than 45" shall be radius type, R=1.5 times duct diameter.
  - 2. Elbows less than 6" shall be of die stamped construction. Elbows 6" or greater shall be 5gore construction.
  - 3. Diverging and converging flow fittings shall be constructed with no excess material projecting from the body into the branch tap entrance. All such fittings shall be 45° "shoe" entrance, wye plus elbow, or 45° lateral branch. Special fittings such as heel tapped elbows and bullhead tees may be used only where shown on drawings. Adjustable elbows and straight saddle taps shall not be used. Low pressure adjustable elbows acceptable.

# 2.4 VAPOR LADEN DUCT

- A. Material: 22-gauge aluminum.
- B. Seams: Seal all seams watertight.
- C. Drainage: Run duct vertical or pitch toward hood.

# 2.5 BELOW GRADE DUCT

- A. Galvanized steel with a 4 MIL polyvinyl chloride coating on the outside.
- B. All connections to be screw fastened and sealed per manufacturers recommendations.
- C. Backfill with bedding material per Section 23 05 03 in accordance with manufacturer's recommendations. Provide lightweight concrete around duct.

# 2.6 MISCELLANEOUS DUCTWORK MATERIALS

- A. General: Provide miscellaneous materials and products of the types and sizes indicated, and where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.
- B. Double wall turning vanes shall be Harper double wall turning vanes fabricated from the same material as the duct. Tab spacing shall be SMACNA standard. Rail systems with non-standard tab spacings shall not be accepted. All tabs shall be used, do not skip tabs. Mounting rails shall have friction insert table, which align the vanes automatically. Vanes shall be subjected to tensile loading and be capable of supporting 250 lbs., when fastened per the manufacturer's instructions. Approved Systems: Ductmate PRO-Rail.
- C. Single wall spliter and turning vanes shall be custom fabricated as specified below.
- D. Ductwork Support Materials: Except as otherwise indicated, provide galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
- E. Duct Liner:
  - 1. Manufacturers:
    - a. Design Basis: Johns-Manville
    - b. Other Acceptable Manufacturers:
      - 1) Certainteed
      - 2) Owens Corning
      - 3) Knauf
  - Model: Minimum 1-1/2" Linacoustic RC with Permacoat (EPA registered antimicrobial coating), in accordance with UL 181, ASTM C1071, G21 and G22 with no observed growth.

- 3. Compliances:
  - a. FSHH-1-545, Type I
  - b. NFPA 90-A
- 4. Roughness: 0.0008 feet
- 5. Noise Reduction Coefficient: 0.85 or higher for 1-1/2" liner
- 6. Round Duct Liner: Spiracoustic "snap-in" type with Permacote.
- F. Duct Liner Adhesive:
  - 1. Manufacturers:
    - a. Design Basis: Childers
    - b. Other Acceptable Manufacturers:
      - 1) King
      - 2) Hardcast
      - 3) Ductmate Industries, Inc., PROTack
  - 2. Model:
    - a. Indoor/Outdoor: CP-127 Chil-Quik
- G. Duct Sealant:
  - 1. Manufacturers:
    - a. Design Basis: Ductmate PROseal
    - b. Other Acceptable Manufacturers:
      - 1) United McGill Duct Sealer WB (Water Based)
      - 2) C.L. Ward SuperSeal
  - 2. Model:
    - a. Indoor: United Duct Sealer, PROseal
    - b. Outdoor: Unicast, PROseal
  - 3. Description: Non-hardening, liquid or mastic elastic sealant.
  - 4. Fire Rating: UL 289U listed and NFC 220(b).
  - 5. Sealants shall contain no VOCs.
- H. Duct Tape Sealing System:
  - 1. Manufacturers:
    - a. Design Basis: Hardcast.
  - 2. Model:
    - a. Tape: DT
    - b. Indoor Adhesive: FTA-20
    - c. Outdoor Adhesive: RTA-50
- I. Acoustical Duct Lagging:
  - 1. Manufacturers:
    - a. Design Basis: Sound Seal
    - b. Other acceptable manufacturers:
      - 1) Kinetics Noise Control

- 2) The Proudfoot Company
- 3) Acoustical Solutions
- c. Model: B-10 LAG/QFA-3, foil face loaded vinyl or lead barrier sheet fully bonded to a minimum 1" thick fiberglass blanket, nominal density of 1.0psf, install so jacket edges overlap by minimum of 6", minimum STC-27 tested by independent laboratory in accordance with ASTM E90 and E413, minimum insertion loss (IL) value at 500Hz shall be 23 and meets IMC flame/smoke ratings in accordance with ASTM E84.
- J. Fiberglass ductboard is not accepted without prior written approval from the specifier.
- K. Access doors shall be hinged or Ductmate Sandwich Type Access Doors manufactured by Ductmate Industries, Inc. Doors shall be of adequate size to allow easy access to hardware, which needs to be maintained.
- L. Flexible Duct Connector:
  - 1. Flexible duct connector shall be used where ductwork connects to fans of apparatus, or apparatus casing to fans.
  - 2. Connectors will meet NFPA 90A and 90B specifications and provide an airtight and waterproof seal.
  - 3. Indoor installations shall be Neoprene or vinyl coated fabrics.
  - 4. Outdoor installations shall use Hypalon coated fabric.
  - 5. Connector shall be Ductmate PROFlex or approved equal.
- M. Roof Mounted Duct Supports
  - 1. Description: The Contractor shall design and detail the self weight support of the roof-top HVAC ducts and their lateral stability to resist WIND and SEISMIC loads. The duct support design shall take into consideration the roof framing load carrying capacity for MEP systems supported above and below the roof and distribute the load effect so as not to overload the roof framing. The system shall consist of vertical hot dipped galvanized or stainless steel frame members or supports with welded 4"x4" base plate for permanent connection to the primary roof framing (not roof decking). The connection points of supports to the roof framing shall be provided with a "pitch pan" and shall be fabricated from the same material as the vertical support members. The "pitch pan" shall interface with roofing membrane, be filled with roofing asphalt, be flashed on all sides, and be provided with a water proof seal. Mechanical Contractor shall coordinate support system with Roofing Contractor and receive his approval. Provide shop drawings of system for review.
- N. Provide seismic restraints as required for seismic zone. See 23 05 49.

# 2.7 FABRICATION

- A. Construct rectangular ductwork to meet all functional criteria defined in Section VII, of the SMACNA "HVAC Duct Construction Standards Metal and Flexible" 2005 Edition. This shall be subsequently referred to as the SMACNA Manual. All ductwork must comply with all local, state and federal code requirements.
- B. All "medium pressure" (systems with external pressures greater than 2" w.c.) duct systems shall be constructed for 4" W.C. positive and 1" W.C. negative static pressure and 3500 FPM velocity.
- C. See air handler and fan schedules for external pressure requirements. All pressures above 2" E.S.P. shall be medium pressure.
- D. All low pressure ductwork is to be constructed for 2" W.C. positive and 1" negative static pressure and 2000 FPM.
- E. All negative pressure ductwork shall be constructed for a minimum of 2" W.C. negative and 2" W.C. positive static pressure and 2000 FPM velocity.
- F. All grease-laden negative pressure ductwork shall be constructed for a minimum of 4" W.C. negative static pressure and 3000 FPM velocity.

- G. Make all changes in direction using 1.5 radius elbows where possible. Use splitter vanes or mitered rectangular elbows with turning vanes otherwise.
  - 1. Use single thickness splitter vanes for all radius elbows less than 1.5 D = r.
    - a. D = diameter of duct or width of duct (in plane of change-in-direction).
    - b. r = radius of duct at duct center-line.
    - c. Use "Curve Ratios" of 0.45 or greater (as defined by figure 3-7 of the 1989 ASHRAE Fundamentals Handbook).
  - 2. Use single thickness turning vanes with no trailing edges in accordance with SMACNA Standards.
    - a. All mitered, rectangular elbows in series.
    - b. All mitered, rectangular elbows less than 36" in width (in plane of change-ofdirection).
  - 3. Use double width, airfoil type turning vanes with no trailing edges for all, rectangular elbows greater than 36" in width (in plane of change-of-direction).
    - a. Isolated elbows have a minimum of 3D straight duct upstream and downstream of the change-in-direction.
- H. Fabricate transition elbows with turning vanes at correct angle so entering and leaving edges are parallel or tangent to air flow.
- I. All branch duct take-offs shall use 45° laterals or 45° "pants-leg" type fittings.

#### PART 3 - EXECUTION

# 3.1 INSTALLATION OF DUCTWORK

- A. Assemble and install ductwork in accordance with recognized industry practices, which will achieve air-tight and noiseless systems, capable of performing each indicated service.
- B. Install each run with a minimum of joints.
- C. Where ducts pass expansion joints or structural elements subject to movement provide flexible connections and supports to allow for movement without adverse effects.
- D. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth.
- E. Support ducts rigidly with suitable ties, braces, hangers and anchors of the type, which will hold ducts true-to-shape to prevent buckling. This Division is responsible for all duct supports.
- F. Seal ducts in accordance with SMACNA requirements for pressure class indicated.
  - 1. Indoor Ducts: Use liquid or mastic sealant, or tape system.
  - 2. Outdoor Ducts: Use tape system.
  - 3. Approved manufactured joining systems with gaskets may be used in lieu of transverse sealing.
- G. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible.
- H. Hold ducts close to walls, overhead construction, columns, and other structural and permanentenclosure elements of the building.
  - 1. Limit clearance to 0.5" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any.
  - 2. Where possible, locate insulated ductwork for 1.0" clearance outside of insulation.

- I. In finished spaces, conceal ductwork by locating in mechanical shafts, hollow wall construction or above suspended ceilings.
- J. Where possible, avoid locating ducts on or near floor.
  - 1. Where ducts must be located low, provide metal trestle to protect duct at places where duct will be climbed over.
- K. Coordinate the layout with suspended ceiling and lighting layouts and similar finished work.
- L. Install access doors where necessary for inspection and maintenance.
  - 1. Provide additional 12" x 12" access door at each low leakage damper.
  - 2. Arrange access doors so that:
    - a. They open against the system air pressure wherever feasible.
    - b. Their latches are operable from either side, except where the duct is too small to be entered.
- M. Where ducts pass through non-fire-rated interior partitions below ceiling and exterior walls:
  - 1. Conceal the space between the construction opening and the duct or duct-plus-insulation with sheet metal flanges of the same gauge as the duct.
  - 2. Overlap the opening on all sides by at least 1-1½".
- N. Provide volume dampers at branch take-offs (except upstream of VAV boxes which should not have dampers).
- O. Provide conical or tapered taps with balancing dampers on all round ductwork takeoffs (except upstream of VAV boxes, which should not have dampers).
- P. Where space permits, round or oval ductwork of equivalent diameter may be substituted for unlined rectangular ductwork.
- Q. Provide 22-gauge aluminum ductwork for the first 20 feet downstream of any aluminum grille. Slope duct towards grille at 1/8" /ft.

# 3.2 DUCT LINER INSTALLATION

- A. Line ductwork as indicated below:
  - 1. Use 1-1/2" thick lining except where noted otherwise.
  - 2. Dimensions indicate inside free area.
  - 3. Line all supply ductwork.
    - a. Round ducts concealed above ceilings and serving individual terminal units or diffusers may be wrapped in lieu of liner (coordinate with insulation contractor and Section 23 07 00).
  - 4. Line all return ductwork.
- B. Ducts Exposed to Weather: Line all low velocity ducts exposed to weather with two inch thick lining.
  - 1. Dimensions indicate free area.
  - 2. Seal ducts to three-inch static pressure standards.
  - 3. Paint exposed surfaces with aluminum asphalt roof paint.
- C. Supply, return or outside air ductwork, which is not lined (as noted above) is to have exterior insulation. See Section 23 07 00 for insulation requirements on unlined ductwork.
  - 1. Coordinate lined duct and insulated duct prior to bid.
  - 2. Coordination of extent of liner or insulation, after bid award, shall be as directed by Engineer at no additional cost to Owner.

- D. Seal all exposed ends of liner with duct liner adhesive back a minimum of 2" from ends. Seal all joints in liner a minimum of 1" overlap. Seal all fasteners.
- E. Completely remove any loose material from each section of lined ductwork as it is installed.
- F. Interrupt duct liner a minimum of 18" upstream and 30 inches downstream of all electric resistance heaters in duct system. If ductwork is used for cooling, wrap that portion of duct which is not lined and extend insulation a minimum of 12" beyond lining in each direction.

# 3.3 DUCT LEAKAGE TESTING

- A. Installed ductwork shall be tested prior to installation of access doors, take-offs, etc.
- B. All leak testing shall be witnessed by the Engineer or representative of the Engineer. The Contractor shall give the Engineer 72 hours notice prior to testing. Any testing not witnessed by the Engineer or his/her representative, shall be considered invalid and will be redone.
- C. The testing shall be performed as follows:
  - 1. Perform testing in accordance with HVAC Air Duct Leakage Test Manual.
  - 2. Use a certified orifice tube for measuring the leakage.
  - 3. Define section of system to be tested and blank off.
  - 4. Determine the percentage of the system being tested.
  - 5. Using the percentage, determine the allowable leakage (cfm) for that section being tested.
  - 6. Pressurize to operating pressure and repair any significant or audible leaks.
  - 7. Repressurize and measure leakage.
  - 8. Repeat steps 6 and 7 until the leakage measured is less than the allowable defined in step 5.

NOTE: It is recommended that the first 100'-300' of ductwork installed be tested to insure the quality of the workmanship at an early stage.

D. All transverse joints and longitudinal seams shall conform to SMACNA's Class A sealing requirements as defined on page 1.17 of the 2005 SMACNA Manual, Third Edition.

| E. | Constant Volume Systems/Supply Ductwork<br>Allowable Leakage                              | 1% of design cfm                     |
|----|-------------------------------------------------------------------------------------------|--------------------------------------|
| F. | Constant Volume Systems/Return Ductwork<br>Allowable Leakage                              | 2% of design cfm                     |
| G. | Variable Air Volume Systems/Supply Ductwork<br>Fan to VAV Boxes<br>VAV Boxes to Registers | 1% of design cfm<br>2% of design cfm |
| Н. | Variable Air Volume Systems/Return Ductwork<br>Allowable Leakage                          | 2% of design cfm                     |

- 3.4 DUCTWORK STORAGE AND CLEANING
  - A. Cleaning:
    - 1. Interior surfaces shall be free of dust and debris prior to initial start up. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes. Any cleaning of duct systems shall comply with recommendations of NAIMA and NADCA.
    - 2. When internally cleaning duct work prior to installation or shipment to the jobsite, all duct ends and openings must be covered prior to transporting with a dual Polyethylene protective film. Film must be securely affixed to protect against dirt and debris and must be translucent to facilitate inspection of interior surfaces without removing film. Film must have a minimum elongation of 600%, contain no VOC and leave no residue on duct after removal.
    - 3. Clean external surfaces of foreign substances that might cause corrosion, deterioration of the metal, or where ductwork is to be painted.

# B. Protection:

- 1. Store duct a minimum of 4" above ground or floor to avoid damage from weather or spills.
- 2. Cover all stored ducts to protect from moisture or debris.
- 3. Cover all ends of installed ductwork at the end of each workday or when dust and debris producing construction (such as fire proofing, drywall, sanding, or core drilling) is occurring.
- C. Ductwork contaminated or damaged above "shop" or "mill" conditions shall be cleaned, repaired or replaced to the Engineer's satisfaction.
  - 1. Ductliner pre-installed in stored duct which has become wet may be installed if first allowed to completely dry out.
  - 2. Ductliner in installed ductwork, which has become wet must be completely removed and replaced.
  - 3. Torn ductliner may be replaced by coating with adhesive if damaged is minor and isolated. Extensively damaged liner shall be replaced back to a straight cut joint.

END OF SECTION 233113

# SECTION 233300 - DUCTWORK ACCESSORIES

PART 1 – GENERAL

- 1.1 INDUSTRY STANDARDS
  - A. Comply with SMACNA (Sheet Metal and Air Conditioning Contractors' National Association) latest recommendations for fabrication, construction and details, and installation procedures, except as otherwise indicated.

#### 1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data on the following:
  - 1. Flexible duct
  - 2. Ceiling dampers
  - 3. Fire dampers
  - 4. Smoke dampers
  - 5. Louvers
  - 6. Louvered penthouses
  - 7. Roof mounted intakes
  - 8. Roof mounted reliefs
  - 9. Gravity relief dampers
  - 10. Sound attenuators

# PART 2 – PRODUCTS

- 2.1 FLEXIBLE DUCT ACOUSTICAL
  - A. Manufacturers:
    - 1. Flexmaster Type 8M.
    - 2. ThermaFlex-MKE
  - B. Construction:

2.

- 1. CPE Liner film mechanically locked without adhesives.
  - Insulation: Minimum  $1-\frac{1}{2}$ " thick fiberglass blanket with a polyethylene vapor barrier. Map 0.23 'c' factor, factory installed.
- 3. Helix: Corrosion resistant galvanized steel.
- C. Pressure rating: 6" w.g. positive, 1" w.g. negative at maximum 180°F operating temperature.
- D. Standards: NFPA90A UL-181, Class I, ASTM E-96 Procedure A.
- E. Insertion loss shall be at least:

|           | OCTAVE BAND (Hz)                                                                |     |     |      |      |      |
|-----------|---------------------------------------------------------------------------------|-----|-----|------|------|------|
| Duct Size | 125                                                                             | 250 | 400 | 1000 | 2000 | 4000 |
| 6"        | 7                                                                               | 31  | 37  |      | 37   | 19   |
| 8"        | 13                                                                              | 29  | 36  | 35   | 29   | 17   |
| 12"       | 10                                                                              | 26  | 29  | 33   | 24   | 12   |
|           | DB reduction for 10 foot length tested in accordance with ASCME 477, @ 2500FPM. |     |     |      |      |      |

# 2.2 FLEXIBLE DUCT, HIGH PRESSURE

- A. Manufacturers:
  - 1. Design Basis: Flexmaster Type 3

- 2. Other Acceptable Manufacturers:
  - a. Thermaflex, MKC
  - b. Genflex, IGE
  - c. American/Elgen
- B. Construction:
  - 1. Insulated: Reinforced inner liner, mechanically locked or bonded together by a corrosive resistant galvanized steel helix, Min. 1-1/2" thick fiberglass blanket with polyethylene vapor barrier. Max. 0.23 'c' factor.
  - 2. Uninsulated: Mechanically locked without adhesives with a corrosion resistant galvanized steel helix.
  - 3. Aluminum: Mechanical lock without adhesives.
- C. Pressure rating:  $12^{\circ}$  w.g. positive,  $1^{\circ}$  w.g. negative at  $180^{\circ}$ F.
- D. Standards: NFPA90A, UL-181 Class I, ASTM E96 Procedure A.

#### 2.3 LOUVERS

A. Louvers are specified in the Architectural Division. This division is responsible for coordinating all duct connections, damper sizes, etc. with the louvers specified.

# 2.4 PREFABRICATED CURBS

- A. General: Except where curbs are provided with equipment, provide prefabricated curbs for all roof mounted equipment.
- B. Manufacturers:
  - 1. Design Basis: Pace
  - 2. Other Acceptable Manufacturers:

a. Thycurb

- C. Model for grease-laden exhaust fans: ES-2.
  - 1. Coordinate to fit vibration isolation rail.
- D. Coordinate with roofing Contractor. Exterior insulation, cants, flashing and counter flashing shall be furnished and installed under roofing work, Division 7.
- E. Model: As required.

## 2.5 GRAVITY RELIEF DAMPERS

- A. Manufacturers:
  - 1. Design Basis: Air Balance.
- B. Model: 702H.
- C. Construction: Nylon bearings, felt weather-stripping, steel frames, and aluminum blades.
- D. Pressure Drop: .018" at 500 fpm.
- 2.6 FIRE DAMPERS
  - A. Manufacturers:
    - 1. Design Basis: Prefco

- 2. Other Acceptable Manufacturers:
  - Air Balance a.
  - b. Ruskin
  - Safe-Air c.
  - d. United Air
  - e. **United Sheetmetal**
  - f. National Controlled Air
  - Air Control Products g.
  - h. Greenheck
  - i. Nailor
- В. Rating: UL555 dynamic 1-1/2 hours, or 3 hours, UL555S Class II leakage rated. Match construction penetrated.
- C. Size: Metal-to-metal for lined and unlined ducts.
- D. Fusible link only. Use Type B "Top Hat" wherever possible.

#### 2.7 FIRE/SMOKE DAMPERS

- Α. Manufacturers:
  - Design Basis: Prefco 1. 2.
    - Other Acceptable Manufacturers:
      - a. National Controlled Air
      - b. Johnson Controls
      - Safe Air c.
      - d. Ruskin
      - Air Balance e.
      - f. Greenheck
      - g. Nailor
- Fire Damper Rating: UL Standard 555 Dynamic, 1-1/2 hour or 3 hours. Β.
- C. Smoke Damper Rating: UL Standard 555S, Class II.
- D. Damper Assembly:
  - Type: 120 volt. 1.
  - Listing: UL 555S, UL555. 2.
  - 3. Rating: Match wall rating.
  - Failure Position: Fail closed. 4.
  - Heat sensor: 165°F fusible link. 5.
  - Blade: Air foil. 6.
  - Seals: Mechanically fastened, rated up to 450°F. 7.
- Ε. Where part of Smoke Control System.
  - 1. Provide end switch for positive indication of damper position.
  - Provide means to re-open damper remotely in the event thermal link trips. Allow for re-2. open up to elevated rating of 250°F.
- 2.8 SMOKE DAMPERS
  - Α. Manufacturers:
    - 1. Design Basis: Prefco
    - 2. Other Acceptable Manufacturers:
      - a. Air Balance

- b. Greenheck
- Johnson Controls C.
- d. National Controlled Air
- Pottorff e.
- f. Ruskin
- Safe Air g.
- h. Nailor
- Β. Smoke Damper Rating: UL Standard 555S, Class II.
- C. Operator:
  - 1. Type: 120 volt.
  - Listing: UL Smoke Damper Operator Label. 2.
  - 3. Failure Position:
    - Smoke control system dampers: As shown on plans. a.
    - b. Others: Closed
- D. Blade: Air foil.
- Ε. Seals: Steel.
- F. Where part of smoke control system:
  - Provide end switch for positive indication of damper position. 1.

#### 2.9 **CEILING DAMPERS**

- Manufacturers: Α.
  - 1. Design Basis: Airstream Products Div. Of Penn Ventilator Company. 2.
    - Other Acceptable Manufacturers:
      - Air Balance a.
      - J&J b.
      - Pottorff C.
      - d. Prefco
      - Ruskin e.
      - f. Safe Air
      - g. Nailor
- В. Model: Duct Defender.
- C. Rating: UL one hour.
- D. Location: Air distribution penetrations in rated ceilings.

#### 2.10 MISCELLANEOUS DUCTWORK ACCESSORIES

- Α. Duct Access Doors: Provide duct access doors with gaskets, and with insulation where ductwork is indicated to be insulated.
  - 1. Manufacturer:
    - a. Design Basis: Cesco
    - b. Model: HAD hinged
  - 2. Other acceptable manufacturers:
    - a. Flexmaster
    - b. Milcor

- c. Elmdor
- B. Flexible Connectors: Fireproof glass cloth, Vent-Fab or approved equal.
  - 1. Manufacturers:
    - a. Design Basis: Vent-Fab
    - b. Other Acceptable Manufacturers:
      - 1) Duro-Dyne
  - 2. Material: Fireproof glass cloth

#### 2.11 BACKDRAFT DAMPERS

- A. Construction:
  - 1. Frame: Extruded aluminum.
  - 2. Blades: Formed aluminum with extruded vinyl edge seals.
  - 3. Bearings: Synthetic
- B. Performance: 12 cfm per square foot at ½" W.G.

# 2.12 BALANCING DAMPERS

- A. Construction:
  - 1. Frame: 16 gauge galvanized steel.
  - 2. Blades: 16 gauge galvanized steel with vinyl edge seals.
  - 3. Bearings: Heavy duty nylon.
  - 4. Performance:
    - a. Maximum pressure drop in full open position (@3000 fpm): 0.55
    - b. Maximum leakage: 32 cfm/sp at 4" W.C.
- B. Type: Rectangular balancing dampers are to be opposed blade type with locking handle, unless otherwise noted.

PART 3 – EXECUTION

- 3.1 INSTALLATION OF ACCESSORIES
  - A. Install fire, smoke and ceiling dampers in accordance with manufacturer's instructions and the latest version of the Fire, Smoke and Radiation Damper Guide for HVAC Systems, published by SMACNA.
  - B. Install access doors where necessary for inspection and maintenance.
    - 1. Provide additional 12" x 12" access door at each low leakage damper.
    - 2. Arrange access doors so that:
      - a. They open against the system air pressure, wherever feasible.
      - b. Their latches are operable from either side, except where the duct is too small to be entered.
      - c. Install flexible connectors at all duct connections to rotating or reciprocating machinery or equipment.
    - 3. Provide access doors at all fire damper locations.
  - C. Use HIGH PRESSURE flexible duct where shown upstream of VAV boxes.

- D. Notify fire alarm provider of smoke damper control requirements and fire alarm interlocks.
- E. Install flexible ductwork without tight bends and free of kinks.
  - 1. Flexible ductwork shall not be less than 4', nor exceed 8' in length.
  - 2. Flexible ductwork shall be installed with a "minimum length of straight duct" upstream of the diffuser neck inlet. "A minimum length" shall mean a length equal to three (3) duct diameters. "Straight duct" shall mean the center-line of the duct shall be aligned with a line perpendicular to the plane of the diffuser neck opening at the center point of the opening.
  - 3. Conform to the detail on the drawings.
- F. Install all dampers, including those furnished by Section 23 09 00 Contractor.
  - 1. Caulk damper frames to ductwork.
  - 2. Make sure dampers are free to operate properly.
  - 3. Install parallel blade mixing dampers to two streams impinge on each other to facilitate mixing.
- G. Provide balance dampers at branch take-off and where required to minimize balancing performed at diffuser face.
- H. Provide all balance dampers as shown on plans and any additional dampers necessary to provide a balanced system meeting all sound requirements.

END OF SECTION 233300

SECTION 233400 - FANS

# PART 1 – GENERAL

# 1.1 QUALITY CONTROL

- A. Provide fans with AMCA performance certification and label.
- B. Grease exhaust fan shall comply with NFPA 96 and be UL listed.

# 1.2 MOTOR HORSEPOWER

A. Do not increase or decrease motor horsepower from that specified without written approval from Architect/Engineer. See Section 23 05 01.

# 1.3 SUBMITTALS

- A. Manufacturer's Data: Submit manufacturer's product data including:
  - 1. Performance
  - 2. Size
  - 3. Type
  - 4. Options provided
  - 5. Fan curves
  - 6. Indicate Compliance with Section 1.1 where applicable.

# PART 2 – PRODUCTS

# 2.1 POWER ROOF VENTILATORS, CENTRIFUGAL

- A. Manufacturers:
  - 1. Acme
  - 2. Carnes
  - 3. Cook
  - 4. Greenheck
- B. Features:
  - 1. Spun aluminum housing.
  - 2. Internal rubber vibration isolators.
  - 3. Ball bearings.
  - 4. Automatic belt tensioner for all motors 15 hp or less.
- C. General:
  - 1. Bird screen.
  - 2. Gravity back-draft damper: 0.2 inches WC max. pd.
  - 3. Motorized type backdraft damper where indicated.
- D. Roof Curb:
  - 1. Curbs will be provided under another Division.
  - 2. Provide dimension data to Supplier of roof curbs.
  - 3. Provide factory fabricated roof curb of height required by local authorities.

# E. Sound Criteria:

- 1. Required sound levels may be attained by use of sound attenuating curbs.
- 2. Fan shall have specified capacity with curb in place.
- 3. Curb pressure drop is not included in specified ratings.

# 2.2 CABINET FAN

- A. Manufacturers:
  - 1. Acme
  - 2. Carnes
  - 3. Cook
  - 4. Greenheck
- B. Cabinet: Steel, acoustically lined.
  - 1. Wheel: Centrifugal.
- C. Back-draft damper: Integral.
- D. Provide rheostatic speed controller for all direct drive fans. Mount under grille or on wall as specified in the drawings.

#### 2.3 CIRCULATION FAN

- A. Manufacturers:
  - 1. Delta T Corporation (Big Ass Fans)
- B. Airfoils: Aluminum, high volume, low speed airfoils.
- C. Winglets: Molded high density polypropylene , attached at the tip of each airfoil.
- D. Provide manufacturer approved mounting system and post to secure fan to structure.
- E. Provide wall mounted controller for each fan.

# PART 3 - EXECUTION

- 3.1 NOISE AND VIBRATION
  - A. Insure that fans are properly supported on vibration isolators. Reference Section 23 05 48 for Vibration Isolation Requirements.
  - B. Insure that flexible duct connections are properly made.
  - C. Check fan for improper balance.
    - 1. Have fan re-balanced if necessary.
  - D. Check for proper rotation.
  - E. Check for unusual noise or vibration and correct as necessary.

# 3.2 ACCESS

A. Provide for proper access to all parts of fan needing inspection or service with access doors in fan or ductwork.

# 3.3 INSTALLATION

- A. Install units level and plumb.
- B. Provide necessary auxiliary supporting steel.
- C. Mount motor and drives so belts run true.
- D. Provide necessary lubrication.
- E. Provide flexible duct connections on inlet and discharge.

# 3.4 CURBS

- A. Provide necessary dimensions and details so roof opening can be provided at the proper time.
- B. Coordinate delivery of curb with roofing contractor so project is not delayed.
- C. Provide a weatherproof installation:
  - 1. Seal all joints including, but not limited to:
    - a. Unit and curb.
    - b. Unit and ducts.

END OF SECTION 233400

# SECTION 233700 - AIR INLETS AND OUTLETS

# PART 1 – GENERAL

# 1.1 CEILING CONSTRUCTION

A. Provide products compatible with ceiling construction.

#### 1.2 SUBMITTALS

A. Submit catalog data including throw, sound, pressure drop and physical dimensions.

#### 1.3 INDUSTRY STANDARDS

A. Provide products tested in accordance with ASHRAE 70-1991 150 Standard 5219, 150 Standard 3741.

# PART 2 - PRODUCTS

## 2.1 GRILLES AND RECTANGULAR DIFFUSERS

- A. Manufacturers:
  - 1. Design Basis: Price
  - 2. Other Acceptable Manufacturers:
    - a. Titus
    - b. Krueger
    - c. Metal Aire
    - d. Anemostat
    - e. Nailor
- B. Material: Steel or aluminum except:
  - 1. Where noted otherwise.
  - 2. Where required otherwise for fire rating.
  - 3. Grilles and diffusers in locker rooms, showers and toilet rooms in locker rooms to be aluminum.
- C. Finish: Baked white enamel except where noted.
- D. Refer to the Drawings for required performance.
- E. Match frame and border types to ceiling system.

# PART 3 – EXECUTION

- 3.1 GENERAL
  - A. Refer to architectural reflected ceiling plan for exact locations and ceiling types.
  - B. Provide all support and framing devices necessary.
  - C. Exposed mounting screws:
    - 1. Use tamper proof screws in countersunk holes.
    - 2. Point screws to match frame.

# DENVER TRAFFIC OPERATIONS COMMAND VEHICLE STORAGE & MODIFICATIONS

D. Install security type devices in accordance with manufacturer's directions.

# SECTION 235500 - GAS FIRED HEATERS

#### PART 1 – GENERAL

#### 1.1 FLAME-SMOKE RATINGS

- A. Except as otherwise indicated, provide air-handling unit thermal insulation in accordance with the following:
  - 1. Flame-spread rating of 25 or less.
  - 2. Fuel-contributed of 50 or less.
  - 3. Smoke-developed rating of 50 or less.

#### 1.2 CERTIFICATION

A. AGA label.

#### 1.3 SUBMITTALS

- A. Submit manufacturer's data, including:
  - 1. Drawings showing overall dimensions of complete assembly.
  - 2. Operating weights.
  - 3. Equipment support requirements.
  - 4. Sizes and locations of connections.
  - 5. Accessories.
  - 6. Auxiliary support requirements.
  - 7. Ratings.

#### PART 2 – PRODUCTS

# 2.1 GAS FIRED ROOFTOP UNIT

- A. Manufacturers:
  - 1. Design Basis: Reznor
  - 2. Other Acceptable Manufacturers:
    - a. Hastings
    - b. Sterling
    - c. Trane
- B. Enclosure:
  - 1. Construction:
    - a. Weathertight
    - b. Insulated
  - 2. Material: Zinc grip steel.
  - 3. Finish: Baked enamel.
  - 4. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
  - 5. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D-1929 for a minimum flash ignition temperature of 610°F.

- 6. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.
- 7. Unit shall be designed to reduce air leakage and infiltration through the cabinet.
- 8. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
- 9. Access to filters, dampers, heaters, fans, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.
- 10. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
- 11. Unit shall be provided with base discharge opening. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.
- 12. Unit shall include lifting lugs on the top of the unit.
- C. Fans and Motors:
  - 1. Type: Centrifugal
  - 2. Drive: Adjustable belt
  - 3. Discharge: Down
  - 4. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.
  - 5. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.
  - 6. Blowers and motors shall be dynamically balanced and mounted on rubber isolators.
  - 7. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
- D. Burner Section:
  - 1. Heat Exchanger: Stainless steel.
  - 2. Burner: Die formed stainless steel.
  - 3. Pilot: Intermittent, spark ignition.
  - 4. Flame Supervision: Electronic.
  - 5. Fan Control:
    - a. Fan switch.
    - b. Limit switch
    - c. Reserve air flow limit switch.
  - 6. Gas Valve:
  - 7. Flue: Power vented.
  - Completely assembled and factory installed heating system shall be integral to unit. UL or CSA approved specifically for outdoor applications for use downstream from refrigerant cooling coils. Threaded connection with plug or cap provided. Provide capability for gas piping connection through side of unit.
  - 9. Heating section shall be factory run tested prior to shipment.
  - 10. Gas Burner shall be forced combustion type power burner, negative pressure gas valve, manual shut-off, hot surface ignition, and flame sensing safety control.
  - 11. Gas Burner Safety Controls: Provide safety controls for the proving of combustion air prior to ignition, and continuous flame supervision. Upon a failure to ignite, two attempts of ignition will occur before lockout of the ignition system.
  - 12. Combustion blower shall be centrifugal type fan with built-in thermal overload protection on fan motor.
  - 13. Heat Exchanger: Provide drum and tube heat exchanger of free floating design manufactured from 18-gauge stainless steel, suitable for 100% outside air at -5F. Factory pressure and leak tested.
  - 14. Limit controls: High temperature limit controls will shut off gas flow in the event of excessive temperatures resulting from restricted indoor airflow or loss of indoor airflow.
  - 15. Burner shall be modulating with a minimum turndown ratio of 4:1.

- E. Filters:
  - 1. Manufacturers:
    - a. Design Basis: Farr.
    - b. Other Acceptable Manufacturers:
      - 1) AAF.
  - 2. Model: 30-30.
  - 3. Type: Disposable.
  - 4. Thickness: One inch.
- F. Mounting: Factory-supplied roof curb.
  - 1. Shape curb to fit shape of roof.
  - 2. Curb shall be manufactured in accordance with the National Roofing Contractors Association guidelines.
  - 3. Contractor shall verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.
  - 4. Contractor shall carefully coordinate roof opening/support requirements with other trades. Failure to coordinate roof openings/support shall <u>NOT</u> be reflected as a change-order to the Owner.
- G. Installation
  - 1. Contractor shall install in accordance with manufacturer's instructions.
  - 2. Mount units on factory built roof mounting frame providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.
- H. Temperature Control:
  - 1. Each unit shall be provided with a factory-installed, programmed and run-tested, stand-alone, microprocessor control system suitable for VAV control.
  - 2. Provide factory mounted Building Automation System control interface to operate with the building management. Communication link shall use a two-wire twisted pair. Coordinate controls interface requirements with controls vendor.
  - 3. Refer to controls drawings for further requirements.
- I. Warranty
  - 1. Provide a full parts warranty for one year from start-up.
  - 2. Provide one year parts warranty, with additional five year heat exchanger limited warranty.

#### 2.2 GAS FIRED UNIT HEATER

- A. Manufacturers:
  - 1. Design Basis: Reznor
  - 2. Other Acceptable Manufacturers:
    - a. Hastings
    - b. Trane
- B. Enclosure:
  - 1. Material: Zinc grip steel.
  - 2. Finish: Baked Enamel.
  - 3. Louvers:
    - a. Horizontal.
    - b. Independently adjustable.

- c. Stops to prevent total closure.
- C. Fan Motor:
  - 1. Totally enclosed.
  - 2. Built-in thermal protection.
- D. Burner Section:
  - 1. Heat Exchanger: Aluminized steel.
  - 2. Burner: Die formed aluminized steel.
  - 3. Pilot: Intermittent, spark ignition.
  - 4. Flame Supervision: Electronic.
  - 5. Fan Control:
    - a. Fan Switch.
  - 6. Gas Valve: Single stage, 24 volt.
- E. Mounting: Two point suspension.
- F. Thermostat: Single stage.

## 2.3 HIGH INTENSITY GAS INFRA-RED SPACE HEATERS

- A. Manufacturers:
  - 1. Design Basis: Detroit Radiant Products.
  - 2. Other Acceptable Manufacturers:
    - a. CoRayVac.
- B. Burner:
  - 1. Natural gas.
  - 2. Glo-coil ignition.
  - 3. Automatic reignition.
  - 4. 100% shut off with power off.
- C. Unit Complete with:
  - 1. Orifice speed.
  - 2. Reflector assembly.
  - 3. Stack and heat shield.
  - 4. Plenum chamber assembly.
  - 5. End frame assembly.
  - 6. End frame.
  - 7. Side frame.
  - 8. Mounting bracket.
- D. Control Cutoff:
  - 1. Special control cutoff shall be furnished and installed in remote location to shut off unit when bridge crane is below unit.
  - 2. Control shall be redundant to assure shut off.

# PART 3 - EXECUTION

#### 3.1 GENERAL

#### A. Installation:

- 1. Install units level and plumb.
- 2. Provide necessary auxiliary supporting steel.
- 3. Mount motors an drives so belts run true.

# B. Adjustments:

- 1. Adjust drive for speed shown in submittal.
- 2. Check motor amps:
  - a. Do not overload motor.
- 3. Check for unusual noise or vibration.
- 4. Provide necessary lubrication.
- 3.2 ROOF TOP UNITS
  - A. Curbs:
    - 1. Provide necessary dimensions and details so roof opening can be provided at the proper time.
    - 2. Coordinate delivery of curb with roofing contractor so project is not delayed.
  - B. Sealing:
    - 1. Provide a weatherproof installation.
      - a. Seal all joints including, but not limited to those between:
        - 1) Unit and curb
        - 2) Unit and ducts
        - 3) Unit and panels

#### 3.3 TUBE TYPE RADIANT HEATERS

- A. Installation:
  - 1. Install units level and plumb.
  - 2. Provide necessary auxiliary supporting steel.
  - 3. Hang units with No. 3 double link chain.
  - 4. Allow for thermal expansion.
  - 5. Uninsulated, 16 gauge steel flue pipe may be used where clearance from combustibles allows.
  - 6. Use Type B vent for roof penetration and near combustibles.

## SECTION 239000 - PROJECT CLOSEOUT

#### PART 1 – GENERAL

#### 1.1 WORK INCLUDED

- A. The contractor shall summarize and document adherence with the requirements of the specifications for project closeout including:
  - 1. Copies of all warranties
  - 2. Operation & Maintenance Manuals
  - 3. Required tests
  - 4. Test and balance reports
  - 5. Record drawings
  - 6. Permit requirements
  - 7. Valve tag list
- B. The contractor shall compile a closeout manual which shall include:
  - 1. A list of all required tests and a place for signoff of date completed.
  - 2. A list of all submittals with dates of acceptance by the engineer.
  - 3. A schedule indicating dates for beginning testing and startup of equipment and dates of tests to be witnessed by the engineer, or designated representative, as required by the specifications.
  - 4. Test procedures to be used for life safety systems.
  - 5. Project close out check list.
- C. The final closeout manual shall include the following:
  - 1. Test reports as required by the specifications with signoff by the appropriate individual (engineer, architect, building official, etc.).
  - 2. Documentation indicating all equipment is operating properly and is fully accessible for maintenance.
  - 3. Copies of all warranties.
  - 4. Test and Balance report.
- D. This section only includes the requirements for documentation of the contract documents, by the contractor, for project completion. This section does not in any way decrease the scope of any of the drawings or specifications.

## 1.2 SUBMITTALS

- A. Within 90 days after notice to proceed submit a preliminary closeout manual with the following:
  - 1. A list of all required tests.
  - 2. Preliminary schedule showing major milestones for completion of the mechanical/plumbing systems.
- B. Within 30 days of the first major milestone submit the completed closeout manual as described in Part 1.
- C. Within 2 weeks of substantial completion submit a completed "Project Closeout Check List", and the Final Closeout Manual.
- D. Listed below is a checklist for use by the contractor. This list is not all inclusive for this project.

Project Close-Out Summary - Mechanical, Plumbing and Fire Protection

- All required submittals have been cleaned, submitted and either been approved or modified in accordance with the Engineer's "make corrections noted" comments. Our records indicate the following submittals are still outstanding:
- Clean filters installed in all units. (Install just prior to building turnover)
- All equipment has been started up and is functioning within manufacturers' recommendations without any undue noise or vibration. (Submit a list of equipment with startup dates. Provide list no later than 120 days prior to project completion date).
- All vibration isolation has been installed and is operating properly.
- Duct access doors have been installed at fire and fire/smoke dampers and are properly fire-stopped and fire and fire/smoke dampers have been visually inspected to confirm that they are open.
- Access doors have been installed as required for concealed equipment, water hammer arrestors, valves, controls, actuators, etc.
- All equipment has been installed with the manufacturers recommended service clearances and is fully accessible for required maintenance.
- All equipment and piping is labeled per specifications.
- All hydronic, gas and plumbing piping cleaned, flushed and tested per specifications. Submit testing reports for record. Submit letter stating domestic water disinfection (chlorination) has been completed per the specifications.
- All action items are complete as listed in the action items reports. Submit a list of action items with sign off by Architect or Engineer for record. Punch list to be completed prior to turn over of building.
- Smoke control system tested and accepted by local authorities (in accordance with specifications). Submit dates for testing along with proposed test procedures.
- Temperature control system complete and tested per specifications.
- Test and balance complete and report submitted and accepted by Engineer.
- Fire sprinkler system and pump tested per specifications.
- Operation and maintenance manuals submitted with table of contents and required documentation for extended warranties.
- Factory Testing documented and submitted for record.
- Record drawings submitted per specifications.
- Temperature Control record documents provided per specifications.

# PART 2 - PRODUCTS (Not Used)

#### PART 3 - EXECUTION

#### 3.1 EQUIPMENT STARTUP AND TESTING

A. Prior to completion and punchlist by the engineer, the contractor shall startup and test each piece of equipment as required by the specifications. The contractor shall provide documentation of all required tests with signoff of by the appropriate individual (engineer, architect, and building official).

#### 3.2 LIFE SAFETY SYSTEMS

- A. All life safety systems shall be fully and successfully tested by the contractor before being witnessed by the engineer or building official
- B. The contractor shall provide a detailed test procedure, with instrumentation to be used, for approval by the engineer and building official prior to any testing.
- C. Once tested by the contractor and fully operational, the systems shall be demonstrated to the engineer. Once accepted by the engineer the system shall be demonstrated to the building and fire officials.

#### 3.3 COORDINATION WITH OTHERS

A. The Division 21 through 23 contractor shall coordinate his requirements with the General Contractor to ensure the other building systems are completed to the point that they will not adversely affect the operation of the Division 21 through 23 systems.

#### 3.4 PUNCH LISTS

- A. The contractor shall submit in writing that the project is ready for final review by the engineer.
- B. Once the project is ready for final review the engineer will create a punch list of any corrections or deficiencies.
- C. The contractor shall complete all punch list items and provide a letter to the architect after completion stating all items have been completed or reasons why they were not completed.
- D. Upon receipt of this letter the engineer will verify that the punch list has been satisfactorily completed.

# BASIC ELECTRICAL REQUIREMENTS

# PART 1 GENERAL

#### 1.01 WORK INCLUDED

- A. Division 26 of the specifications covers the electrical systems of the project. Provide all items and work indicated on the Drawings and all items and work called for in these Specifications. Include all incidentals, equipment, appliances, services, hoisting, scaffolding, supports, tools, supervision, labor, consumable items, fees, permits, licenses, etc., necessary to provide complete and working electrical systems.
- B. The work of Division 26 includes but is not limited to:
  - 1. Grounding and bonding.
  - 2. Hangers and Supports.
  - 3. Electrical Identification
  - 4. Raceway Systems.
  - 5. Wiring Systems.
  - 6. Branch circuit wiring.

#### 1.02 RELATED WORK

- A. General Conditions: Division 1.
- B. Mechanical Requirements: Division 23.

#### 1.03 REFERENCES

- A. National Electrical Code: NFPA 70.
- B. National Electric Safety Code: ANSI/IEEE C2.
- C. Life Safety Code: NFPA 101.
- D. Conform to the Building Code of the local jurisdiction.
- E. Obtain all required permits and pay all required fees.
- 1.04 ELECTRICAL SUBMITTALS
  - A. Submit Product Data catalog cuts for all material items identified in the sections that follow.
  - B. Submit Shop Drawings and Product Data for all systems identified in the sections that follow.
  - C. Submittal of shop drawings, product data, and samples will be accepted only when submitted by the Contractor. Each submittal shall be reviewed for general conformance with contract requirements and stamped by the respective contractor prior to submittal to the Architect/Engineer. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed unless written prior approval is obtained by the Contractor.
  - D. Submit Certificate of Final Inspection.
  - E. All equipment shall conform to the State and/or local Energy Conservation Standards.

- F. Before starting work, prepare and submit to the Architect/Engineer two (2) sets of all shop drawings, descriptive product data, and samples required for the project. Continue to submit two (2) sets, after each Architect/Engineer's action, until a "No Exception Taken" or "Make Correction Noted" action is received with the exception of Fire Alarm submittals which must be submitted until a "NO EXCEPTION TAKEN" action is received. The Engineer will complete an initial review and, if required, a single subsequent review of the submittal. If the submittal requires a third review or additional reviews, the Owner may withhold amount(s) necessary from Contractor's final request for Payment to reimburse the Engineer at their standard hourly rates. Submittal shall include the following specified materials and, in addition, any materials not listed below but which are specified in the individual sections of Division 26 which follow.
- G. Submit proposed changes to electrical room or other equipment room layouts when revised from contract documents.
- H. All electrical submittals shall be assembled into a single package after approval of all sections.
  - 1. Submittals shall be provided in expandable, three-post, hard back binders.
  - 2. Each submittal shall be tabbed by the electrical specification section it is specified in.
  - 3. An index shall be provided which includes:
    - a. Product
      - 1) Plan Code (if applicable)
      - 2) Specification Section
      - 3) Manufacturer and Model Number.
  - 4. Submittals shall be provided for review within three (3) weeks from award of contract to successful bidder.
  - 5. Mark submittals with designations as shown on the drawings and identify as required by Specification Sections. Identification shall contain the information as required in details and each label shall be submitted in list form with disconnects, MCC's, panelboards, switchboards, overcurrent protection devices and utilization equipment.
    - a. Within 10 days after date of Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
    - b. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
    - c. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
      - 1) Include written certification that major contractors have reviewed and accepted proposed schedule.
    - d. Within 10 days after joint review, submit complete schedule.
    - e. Submit updated schedule with each Application for Payment.

#### 1.05 QUALITY ASSURANCE

- A. Qualified Contractor with at least three years successful installation experience on projects of similar type and scope.
- B. Accomplish work in a manner which is compatible with industry standards and practices. Provide skilled electricians as workmen, licensed where required. Upon request, workmen shall provide proof of license.
- C. Provide a foreman or lead electrician with prior experience as a job foreman or lead electrician. Provide documentation and history of performance as foreman or lead electrician if so directed by Architect/Engineer.
- 1.06 DELIVERY, STORAGE AND HANDLING
  - A. Deliver and store materials and equipment in manufacturers' unopened and undamaged containers fully identified with manufacturer's name, trade name, type, class, grade, size and color.
  - B. Store materials and equipment in a safe manner outside of facilities to protect from damage.

# 1.07 PERMITS AND FEES

A. Contractor shall arrange for and pay for all inspections, licenses and certificates required in connection with the work.

# 1.08 SEQUENCING/SCHEDULING

- A. Due to the type of installation, a fixed sequence of steps may be required to properly install the complete systems. Coordinate and schedule work with other trades in accordance with the construction sequence.
- B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for electrical installations.

#### 1.09 COORDINATION

- A. The Drawings and Specifications are complimentary. What is called for by one shall be as if required by both.
- B. Drawings are diagrammatic and indicate general design, layout, and arrangement of equipment and systems. Drawings do not show all details such as junctions boxes, pull boxes, conduit runs or sizes, wiring, etc. necessary for a complete and operable system.
- C. Examine and compare the Electrical Drawings and Specifications with the Drawings and Specifications of other trades. Report any discrepancies between them to the Architect/Engineer prior to bidding. Obtain written instructions for changes necessary in the electrical work.
- D. Install and coordinate the electrical work in cooperation with other trades installing interrelated work. Make proper provisions to avoid interference in a manner approved by the Architect/Engineer. All changes required in the work of the Contractor, caused by his neglect to coordinate the work, shall be made by him at his own expense.
- E. Wiring Diagrams: Provide wiring diagrams indicating field installed electrical power and control wiring and cabling layouts, overcurrent protective devices, equipment, and equipment connections.
- F. Coordinate the installation of electrical materials and equipment above and below suspended ceilings, luminaires and other building components. Ductwork and piping shall not be installed above electrical panelboards, switchboards, motor control centers, and transformers.
- G. CUTTING AND PATCHING
  - 1. This Article specifies the cutting and patching of electrical equipment, components, and materials to include removal and legal disposal of selected materials, components, and equipment.
  - 2. Refer to Division 1 Section covering cutting and patching for general requirements.
  - 3. Do not endanger or damage Work through procedures and processes of cutting and patching.
  - 4. Arrange for repairs required to restore other work, because of damage caused as a result of electrical installations.
  - 5. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.
  - 6. Perform cutting, fitting, and patching of electrical equipment and materials required to:
    - a. Uncover Work to provide for installation of ill-timed Work;
    - b. Remove and replace defective Work;
    - c. Remove and replace Work not conforming to requirements of the Contract Documents;
    - d. Remove samples of installed Work as specified for testing;
    - e. Install equipment and materials in existing structures;
    - f. Upon written instructions from the Architect/Engineer, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
  - 7. Cut, remove and legally dispose of selected electrical equipment, components, and materials as indicated, including, but not limited to removal of conductors, conduit, luminaires, boxes, devices and other electrical items made obsolete by the new Work.
  - 8. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

- 9. Maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
- 10. Locate, identify, and protect mechanical and electrical services passing through remodel or demolition area and serving other areas required to be maintained operational.

## 1.10 CONTRACT CLOSEOUT

- A. Remove all materials, scrap, etc. relative to the electrical installation. Leave the premises in a clean and orderly condition. Clean electrical equipment and materials of foreign matter. Clean light fixtures using methods and materials recommended by the manufacturer. Replace all burned out lamps.
- B. Demonstrate to the Owner the operation of the entire electrical installation. Special systems shall be demonstrated by manufacturer's representative as required in the sections that follow and at no additional cost to the Owner.
- C. Submit keys for electrical switches, panels, etc. to the General Contractor.
- 1.11 RECORD CONSTRUCTION DRAWINGS
  - A. Maintain a complete set of Drawings and Specifications at the project site with all addenda, change orders, field orders, or deviations from the Drawings during construction recorded thereon. Do not use this for any other purpose.
  - B. Drawings shall be maintained up-to-date and indicate actual routing of all concealed feeder conduits, all spare conduits, spare or unused circuitry, and buried work.
  - C. Indicate actual routing of all concealed feeder conduits, all spare conduits, spare or unused circuitry, and buried work. Update all panel schedules with revised circuit numbers and loads. Accurately reconcile and total all panel loads.
  - D. Upon completion of the work, submit drawings to the Architect/Engineer. This contract will not be considered completed until these record documents have been received and reviewed by the Architect/Engineer.

## 1.12 PRODUCT LISTING

- A. Prepare a list of major electrical equipment and materials for the project. A sample schedule is included at the end of this section to complete this requirement.
- B. Provide a product listing within two (2) weeks from award of contract to successful bidder.
- C. For conduit, wire and fittings, the Contractor shall select a prime and alternate manufacturer from the list of acceptable manufacturers provided in the appropriate sections of this Division. The prime and alternate manufacturers shall be identified in the product listing. The Contractor shall make every effort to use the prime manufacturer for the entire project. If products from this manufacturer are unavailable, the Contractor shall use the listed alternate with the following provisions:
  - 1. Wire: All wire placed in a single conduit or installed in multiple conduits making up parallel feeders shall be of the same manufacturer.
  - 2. Conduit and Fittings: All conduits and fittings installed exposed within the same room or immediate area shall be of the same manufacturer.
  - 3. Provide products which are compatible within systems and connected items.

#### 1.13 OPERATIONS AND MAINTENANCE MANUALS

- A. Prepare hard bound manuals which contain complete typewritten instructions for maintenance, parts, operation, and wiring diagrams modified to reflect as-built conditions. Submit number of copies required by Division 1 to the General Contractor.
- B. Include the following information in the manuals:
  - 1. Final accepted product data and shop drawings as submitted in "Electrical Submittals."
  - 2. Description of function, normal operating characteristics and limitations, fuse curves, engineering
    - data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
  - 3. Complete list of parts and complete wiring diagrams.

- 4. Names, addresses and telephone numbers of the Contractor, Sub-contractors and local company responsible for maintenance of each system or piece of equipment.
- All information shall be permanently bound in a 3-ring binder. The job name and address and Contractor's name and address shall be placed on the cover and spine of each binder in a permanent manner. Dymo-tape is not acceptable.
- 6. Copies of all test reports shall be included in the manuals.

## 1.14 TESTING

- A. Submit test reports as outlined in Division 1 Sections on Quality Control Services and each Division 26 Section.
- B. Testing as required by these specifications shall pertain to all equipment, wiring, devices, etc. installed under this contract and being reused.
- C. General Scope:
  - 1. Perform all tests and operational checks to assure that all electrical equipment, both Contractor and Owner-supplied, is operational within industry and manufacturer's tolerances and is installed in accordance with design specifications.
  - 2. The tests and operational checks shall determine the suitability for energization.
  - 3. Schedule tests and give a minimum of two weeks advance notice to the Architect. Reschedule testing for Owner convenience if required.
  - 4. Test Report: Submit three (3) copies of the completed report to the Architect no later than fifteen (15) days after completion of test unless directed otherwise. The test report shall be bound and its contents certified.
    - a. The test report shall include the following:
      - 1) Project information including: Building name, address, date, and other pertinent information.
      - 2) List of equipment tested.
      - 3) Description of test.
      - 4) List of test equipment used and calibration date.
      - 5) Baseline, acceptable, or published target value for test within code or standard reference indicating where value was derived.
      - 6) Test results that summarize all measured values with baseline values.
      - 7) Conclusions and recommendations.
      - 8) Appendix, including appropriate test forms that show all measured values.
  - 5. Failure to meet test:
    - a. Any system material or workmanship which is found defective on the basis of performance tests shall be reported directly to the Architect.
    - b. All failed tests shall be sent immediately by fax to Engineer with proposed corrective action and proposed re-test date and time.
    - c. Contractor shall replace the defective material or equipment as necessary, and have test repeated until test proved satisfactory without additional cost to the Owner.
    - d. The Contractor or testing agency shall have a calibration program which maintains all applicable test instrumentation within rated accuracy. The accuracy shall be traceable to the National Institute if Standards and Technology (NIST) in an unbroken chain. Instruments shall be calibrated in accordance with the following frequency schedule:
      - 1) Field Instruments: 6 months.
      - 2) Laboratory Instruments: 12 months.
      - 3) Leased specialty equipment: 12 months.
    - e. Dated calibration labels shall be visible on all test equipment.

## 1.15 CLEANING

- A. Refer to the Division 1 Section on project closeout or final cleaning for general requirements for final cleaning.
- B. Clean luminaires, lamps and lenses prior to final acceptance. Replace inoperative lamps.

## 1.16 PROJECT CLOSEOUT LIST

- A. The Contractor shall be responsible for providing the items listed on the checklist prior to final observation. Required test reports shall be included in the O&M Manuals.
- B. Additional Submittal Requirements:

## BASIC ELECTRICAL REQUIREMENTS

# DTO - COMMAND VEHICLE STORAGE

- 1. Identification nomenclature for all equipment being furnished.
- 2. Completed record drawings.
- 3. Training list of all training required with Owner sign-offs that training is completed for each requirement.
- 4. Walkdown data sheet index showing all walkdown composite data sheets signed-off as submitted.
- 5. Spare parts list with sign-offs by Owners Representative for each item.
- 6. Signed-off observation reports and punch lists.

# 1.17 CONSTRUCTION REQUIREMENTS

- A. The Contractor shall maintain and have available at the jobsite current information on the following at all times:
  - 1. Up to date record drawings.
  - 2. Submittals.
  - 3. Site observation reports with current status of all action items.
  - 4. Test results including recorded values, procedures, and other findings.
  - 5. Outage information.

# PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

# 3.01 GENERAL

- A. The Drawings indicate the general design and arrangement of circuits, outlets, equipment, systems, etc. Information shown is diagrammatic. Do not scale the drawings for dimensions. Take dimensions, locations, and levels, etc. from the Architectural Drawings and from manufacturer's installation drawings for the equipment being furnished.
- B. Comply with state and local code requirements which exceed the requirements of the National Electrical Code as interpreted by the local inspection authority who has final jurisdiction.
- C. Comply with requirements of the utility company.
- 3.02 PRODUCTS
  - A. Equipment and materials shall comply with the latest standards of National Electrical Manufacturers' Association (NEMA), Underwriters' Laboratories (UL), Institute of Electrical Electronic Engineers (IEEE), and the American National Standards Institute (ANSI). Equipment and materials shall be UL Listed and Labeled for the purpose intended and bear the UL label.

# MINOR ELECTRICAL DEMOLITION

## PART 1 GENERAL

#### 1.01 SECTION INCLUDES

A. Electrical demolition.

#### PART 2 PRODUCTS

- 2.01 MATERIALS AND EQUIPMENT
  - A. Materials and equipment for patching and extending work: As specified in individual sections.

## PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that abandoned wiring and equipment serve only abandoned facilities.
- B. Beginning of demolition means installer accepts existing conditions.

#### 3.02 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
- B. Coordinate utility service outages with utility company.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

#### 3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Remove, relocate, and extend existing installations to accommodate new construction.
- B. Remove abandoned wiring to source of supply.
- C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
- E. Repair adjacent construction and finishes damaged during demolition and extension work.
- F. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

#### 3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

# BUILDING WIRE AND CABLE

# PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Underground feeder and branch-circuit cable.
- C. Metal-clad cable.
- D. Wiring connectors.
- E. Electrical tape.
- F. Oxide inhibiting compound.
- G. Wire pulling lubricant.

#### 1.02 RELATED REQUIREMENTS

- A. Section 07 8400 Firestopping.
- B. Section 26 0501 Minor Electrical Demolition: Disconnection, removal, and/or extension of existing electrical conductors and cables.
- C. Section 26 0526 Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- D. Section 31 2316.13 Trenching: Excavating, bedding, and backfilling.
- E. Section 31 2323 Fill: Bedding and backfilling.

#### 1.03 REFERENCE STANDARDS

- A. ASTM B3 Standard Specification for Soft or Annealed Copper Wire; 2001 (Reapproved 2007).
- B. ASTM B8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.
- C. ASTM B787/B787M Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2009).
- D. ASTM B800 Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes -Annealed and Intermediate Tempers; 2005.
- E. ASTM B801 Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy Wire for Subsequent Covering of Insulation; 2007.
- F. ASTM D3005 Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.
- G. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- H. NECA 104 Recommended Practice for Installing Aluminum Building Wire and Cable; National Electrical Contractors Association; 2006 (NECA/AA 104).
- I. NECA 120 Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); National Electrical Contractors Association; 2006.
- J. NEMA WC 70 Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; National Electrical Manufacturers Association; 2009 (ANSI/NEMA WC 70/ICEA S-95-658).

- K. NFPA 70 National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 44 Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
- M. UL 83 Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- N. UL 486A-486B Wire Connectors; Current Edition, Including All Revisions.
- O. UL 486C Splicing Wire Connectors; Current Edition, Including All Revisions.
- P. UL 486D Sealed Wire Connector Systems; Current Edition, Including All Revisions.
- Q. UL 510 Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.
- R. UL 1569 Metal-Clad Cables; Current Edition, Including All Revisions.
- 1.04 ADMINISTRATIVE REQUIREMENTS
  - A. Coordination:
    - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
    - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
    - 3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- 1.05 SUBMITTALS
  - A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
  - B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- 1.06 QUALITY ASSURANCE
  - A. Conform to requirements of NFPA 70.
- 1.07 DELIVERY, STORAGE, AND HANDLING
  - A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

# PART 2 PRODUCTS

- 2.01 CONDUCTOR AND CABLE APPLICATIONS
  - A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
  - B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
  - C. Nonmetallic-sheathed cable is not permitted.
  - D. Underground feeder and branch-circuit cable is not permitted.
  - E. Service entrance cable is not permitted.
  - F. Armored cable is not permitted.
  - G. Metal-clad cable is permitted only as follows:
    - 1. Where not otherwise restricted, may be used:
      - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
      - b. Where concealed in hollow stud walls and above accessible ceilings for branch circuits up to 20

Α.

- 1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.
- 2. In addition to other applicable restrictions, may not be used:
  - a. Unless approved by Owner.
  - b. Where not approved for use by the authority having jurisdiction.
  - c. Where exposed to damage.

# 2.02 ALL CONDUCTORS AND CABLES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose indicated.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductor Material:
  - 1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
    - a. Substitution of aluminum conductors for copper is permitted, when approved by Owner and authority having jurisdiction, only for the following:
      - 1) Feeders: Copper conductors size 1/0 AWG and larger.
    - b. Where aluminum conductors are substituted for copper, comply with the following:
      - 1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
        - 2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
        - 3) Provide aluminum equipment grounding conductor sized according to NFPA 70.
  - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
  - 3. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.
- H. Conductor Color Coding:
  - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
  - 2. Color Coding Method: Integrally colored insulation.
    - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
  - 3. Color Code:
    - a. 480Y/277 V, 3 Phase, 4 Wire System:
      - 1) Phase A: Brown.
      - 2) Phase B: Orange.
      - 3) Phase C: Yellow.
      - 4) Neutral/Grounded: Gray.
    - b. 208Y/120 V, 3 Phase, 4 Wire System:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
      - 3) Phase C: Blue.
      - 4) Neutral/Grounded: White.
    - c. Equipment Ground, All Systems: Green.

# 2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Description: Single conductor insulated wire.

- B. Conductor Stranding:
  - 1. Feeders and Branch Circuits:
    - a. Size 10 AWG and Smaller: Solid.
    - b. Size 8 AWG and Larger: Stranded.
- C. Insulation Voltage Rating: 600 V.
- D. Insulation:
  - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2.

# 2.04 METAL-CLAD CABLE

- A. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
- B. Conductor Stranding:
  - 1. Size 10 AWG and Smaller: Solid.
  - 2. Size 8 AWG and Larger: Stranded.
- C. Insulation Voltage Rating: 600 V.
- D. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- E. Grounding: Full-size integral equipment grounding conductor.
- F. Armor: Steel, interlocked tape.

#### 2.05 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Wiring Connectors for Splices and Taps:
  - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
  - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- C. Wiring Connectors for Terminations:
  - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
  - 2. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
- D. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
- E. Mechanical Connectors: Provide bolted type or set-screw type.
- F. Compression Connectors: Provide circumferential type or hex type crimp configuration.

## 2.06 WIRING ACCESSORIES

- A. Electrical Tape:
  - 1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight: suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
  - Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
- B. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
- C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Circuiting Requirements:
  - 1. Unless dimensioned, circuit routing indicated is diagrammatic.
  - 2. When circuit destination is indicated and routing is not shown, determine exact routing required.
  - 3. Arrange circuiting to minimize splices.
  - 4. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
  - 5. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
- B. Install products in accordance with manufacturer's instructions.
- C. Install conductors and cable in a neat and workmanlike manner in accordance with NECA 1.
- D. Install aluminum conductors in accordance with NECA 104.
- E. Install metal-clad cable (Type MC) in accordance with NECA 120.
- F. Installation in Raceway:
  - 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
  - 2. Pull all conductors and cables together into raceway at same time.
  - 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
  - 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
- I. Terminate cables using suitable fittings.
  - 1. Metal-Clad Cable (Type MC):
    - a. Use listed fittings.
    - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
- J. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.
- K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- L. Make wiring connections using specified wiring connectors.
  - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
  - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
  - 3. Do not remove conductor strands to facilitate insertion into connector.

- 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
- 5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
- 6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
- 7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- M. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
- N. Insulate ends of spare conductors using vinyl insulating electrical tape.
- O. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

# GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

# PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Grounding and bonding components.
- B. Provide all components necessary to complete the grounding system(s) consisting of:
  - 1. Metal frame of the building.
  - 2. Concrete-encased electrode.
  - 3. Rod electrodes.

#### 1.02 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### 1.03 SUBMITTALS

A. Product Data: Provide for grounding electrodes and connections.

## 1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

## PART 2 PRODUCTS

#### 2.01 ELECTRODES

- A. Rod Electrodes: Copper.
  - 1. Diameter: 5/8 inch (\_\_\_\_ mm).
  - 2. Length: 10 feet (3000 mm).

## 2.02 CONNECTORS AND ACCESSORIES

- A. Mechanical Connectors: Bronze.
- B. Wire: Stranded copper.
- C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

## PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify existing conditions prior to beginning work.
- B. Verify that final backfill and compaction has been completed before driving rod electrodes.

#### 3.02 INSTALLATION

- A. Install ground electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
- B. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing where indicated. Bond steel together.
- C. Provide bonding to meet requirements described in Quality Assurance.
- D. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

# HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

# PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Conduit and equipment supports.
- B. Anchors and fasteners.

# 1.02 REFERENCE STANDARDS

- A. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NFPA 70 National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### 1.03 SUBMITTALS

A. Product Data: Provide manufacturer's catalog data for fastening systems.

#### 1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

#### PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Hangers, Supports, Anchors, and Fasteners General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
- B. Supports: Fabricated of structural steel or formed steel members; galvanized.
- C. Anchors and Fasteners:

#### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
  1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- B. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- C. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- D. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch (25 mm) off wall.
- E. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

# CONDUIT

# PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Intermediate metal conduit (IMC).
- C. PVC-coated galvanized steel rigid metal conduit (RMC).
- D. Flexible metal conduit (FMC).
- E. Liquidtight flexible metal conduit (LFMC).
- F. Electrical metallic tubing (EMT).
- G. Rigid polyvinyl chloride (PVC) conduit.
- H. Conduit fittings.

## 1.02 RELATED REQUIREMENTS

- A. Section 07 8400 Firestopping.
- B. Section 26 0519 Low-Voltage Electrical Power Conductors and Cables: Metal clad cable (Type MC) and armored cable (Type AC), including uses permitted.
- C. Section 26 0526 Grounding and Bonding for Electrical Systems.
- D. Section 26 0529 Hangers and Supports for Electrical Systems.
- E. Section 26 0553 Identification for Electrical Systems: Identification products and requirements.
- F. Section 31 2316 Excavation.
- G. Section 31 2316.13 Trenching: Excavating, bedding, and backfilling.
- H. Section 31 2323 Fill: Bedding and backfilling.

#### 1.03 REFERENCE STANDARDS

- A. ANSI C80.1 American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
- B. ANSI C80.3 American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.
- C. ANSI C80.6 American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.
- D. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- E. NECA 101 Standard for Installing Steel Conduits (Rigid, IMC, EMT); National Electrical Contractors Association; 2006.
- F. NECA 111 Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); National Electrical Contractors Association; 2003.
- G. NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2007.
- H. NEMA RN 1 Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; National Electrical Manufacturers Association; 2005.
- I. NEMA TC 2 Electrical Polyvinyl Chloride (PVC) Conduit; National Electrical Manufacturers Association; 2003.
- J. NEMA TC 3 Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association; 2004.
- K. NFPA 70 National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by

Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

- L. UL 1 Flexible Metal Conduit; Current Edition, Including All Revisions.
- M. UL 6 Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- N. UL 360 Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
- O. UL 514B Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- P. UL 651 Schedule 40 and 80 Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- Q. UL 797 Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- R. UL 1242 Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

## 1.04 ADMINISTRATIVE REQUIREMENTS

## A. Coordination:

- 1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
- 2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
- 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
- 4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
- 5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.
- 1.05 SUBMITTALS
  - A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
  - B. Shop Drawings:
    - 1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
    - 2. Include proposed locations of roof penetrations and proposed methods for sealing.
- 1.06 QUALITY ASSURANCE
  - A. Conform to requirements of NFPA 70.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

## PART 2 PRODUCTS

- 2.01 CONDUIT APPLICATIONS
  - A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
  - 1. Exterior, Direct-Buried: Use PVC-coated galvanized steel rigid metal conduit or rigid PVC conduit.
  - 2. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
- D. Embedded Within Concrete:
  - 1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
  - 2. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from concrete.
- E. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- F. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- G. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- H. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.
- I. Connections to Vibrating Equipment:
  - 1. Dry Locations: Use flexible metal conduit.
  - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
  - 3. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.
  - 4. Vibrating equipment includes, but is not limited to:
    - a. Transformers.
    - b. Motors.

## 2.02 CONDUIT REQUIREMENTS

- A. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
- C. Minimum Conduit Size, Unless Otherwise Indicated:
  - 1. Branch Circuits: 1/2 inch (16 mm) trade size.
  - 2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
  - 3. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
  - 4. Underground, Exterior: 1 inch (27 mm) trade size.
- D. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- 2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)
  - A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
  - B. Fittings:
    - 1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
    - 2. Material: Use steel or malleable iron.

3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

# 2.04 INTERMEDIATE METAL CONDUIT (IMC)

- A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- B. Fittings:
  - 1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 2. Material: Use steel or malleable iron.
  - 3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

## 2.05 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil (1.02 mm).
- C. PVC-Coated Fittings:
  - 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
  - 2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
  - 3. Material: Use steel or malleable iron.
  - 4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil (1.02 mm).
- D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil (0.38 mm).

#### 2.06 FLEXIBLE METAL CONDUIT (FMC)

A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

# B. Fittings:

- 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
- 2. Material: Use steel or malleable iron.

## 2.07 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

## B. Fittings:

- 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
- 2. Material: Use steel or malleable iron.

## 2.08 ELECTRICAL METALLIC TUBING (EMT)

- A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- B. Fittings:
  - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 2. Material: Use steel or malleable iron.
  - 3. Connectors and Couplings: Use set-screw type.
    - a. Do not use indenter type connectors and couplings.
  - 4. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.

# 2.09 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- B. Fittings:
  - 1. Manufacturer: Same as manufacturer of conduit to be connected.
  - Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

#### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that field measurements are as shown on drawings.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
- F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- G. Conduit Routing:
  - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
  - 2. When conduit destination is indicated and routing is not shown, determine exact routing required.
  - 3. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
  - 4. Arrange conduit to maintain adequate headroom, clearances, and access.
  - 5. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
- H. Conduit Support:
  - 1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
  - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- I. Connections and Terminations:
  - 1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
  - 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
  - 3. Use suitable adapters where required to transition from one type of conduit to another.
  - 4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
  - 5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
  - 6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
  - 7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- J. Penetrations:
  - 1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.

- 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
- 3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
- 4. Conceal bends for conduit risers emerging above ground.
- 5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
- 6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
- 7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
- 8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- K. Underground Installation:
  - 1. Provide trenching and backfilling in accordance with Sections 31 2316 and 31 2323.
  - 2. Minimum Cover, Unless Otherwise Indicated or Required:
    - a. Underground, Exterior: 24 inches (610 mm).
  - 3. Provide underground warning tape in accordance with Section 26 0553 along entire conduit length for service entrance where not concrete-encased.
- L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
  - 1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
  - 2. Where conduits are subject to earth movement by settlement or frost.
- M. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
  - 1. Where conduits pass from outdoors into conditioned interior spaces.
  - 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- N. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches (300 mm) at each end.
- O. Provide grounding and bonding in accordance with Section 26 0526.
- P. Identify conduits in accordance with Section 26 0553.

#### 3.03 FIELD QUALITY CONTROL

- A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- B. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- C. Correct deficiencies and replace damaged or defective conduits.

## 3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

## 3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

BOXES

## PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Wall and ceiling outlet boxes.
- B. Pull and junction boxes.

## 1.02 RELATED REQUIREMENTS

- A. Section 26 0553 Identification for Electrical Systems: Identification products and requirements.
- B. Section 26 2716 Electrical Cabinets and Enclosures.
- C. Section 26 2726 Wiring Devices: Wall plates in finished areas.

## 1.03 REFERENCE STANDARDS

- A. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NEMA OS 1 Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2008.
- C. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2008.
- D. NFPA 70 National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

# 1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Provide products listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

## PART 2 PRODUCTS

# 2.01 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
  - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch (13 mm) male fixture studs where required.
- B. Wall Plates for Finished Areas: As specified in Section 26 2726.

# 2.02 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
   1. Material: Galvanized cast iron.
  - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

# PART 3 EXECUTION

## 3.01 INSTALLATION

- A. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.
- B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.
- C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 2726.
- D. Maintain headroom and present neat mechanical appearance.
- E. Coordinate mounting heights and locations of outlets mounted above counters, benches, and

backsplashes.

- F. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- G. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- H. Locate outlet boxes so that wall plates do not span different building finishes.
- Do not install flush mounting box back-to-back in walls; provide minimum 6 inches (150 mm) separation.
   Provide minimum 24 inches (600 mm) separation in acoustic rated walls.
- J. Use adjustable steel channel fasteners for hung ceiling outlet box.
- K. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches (305 mm) of box.
- L. Use gang box where more than one device is mounted together. Do not use sectional box.

#### 3.02 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closures in unused box openings.

# 3.03 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore finish.

# IDENTIFICATION FOR ELECTRICAL SYSTEMS

# PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Warning signs and labels.

## 1.02 REFERENCE STANDARDS

- A. ANSI Z535.2 American National Standard for Environmental and Facility Safety Signs; 2007.
- B. ANSI Z535.4 American National Standard for Product Safety Signs and Labels; 2007.
- C. NFPA 70 National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 969 Marking and Labeling Systems; Current Edition, Including All Revisions.

# 1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
  - 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
  - 2. Do not install identification products until final surface finishes and painting are complete.

## 1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- B. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.
- 1.05 QUALITY ASSURANCE
  - A. Conform to requirements of NFPA 70.
- 1.06 FIELD CONDITIONS
  - A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.
- PART 2 PRODUCTS

## 2.01 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
  - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
    - a. Panelboards:
      - 1) Identify voltage and phase.

- 2) Identify power source and circuit number. Include location when not within sight of equipment.
- 3) Identify available fault current as calculated on the consturction documents.
- 4) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
- b. Transformers:
  - 1) Identify kVA rating.
  - 2) Identify voltage and phase for primary and secondary.
  - 3) Identify power source and circuit number. Include location when not within sight of equipment.
- c. Enclosed switches, circuit breakers, and motor controllers:
  - 1) Identify voltage and phase.
  - 2) Identify load(s) served. Include location when not within sight of equipment.
- d. Busway:
  - 1) Identify ampere rating.
  - 2) Identify voltage and phase.
  - Factory-installed nameplate is acceptable for identification of busway, provided it is permanently affixed to equipment, is in plain sight once installed and includes ampere and voltage ratings.
- 2. Service Equipment:
  - a. Use identification nameplate to identify each service disconnecting means.
  - b. Use identification nameplate at each piece of service equipment to identify the available fault current and the date calculations were performed.
- 3. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
  - a. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
- B. Identification for Conductors and Cables:
  - 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
  - Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
- C. Identification for Raceways:
  - 1. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
  - 2. Use underground warning tape to identify underground raceways.
- D. Identification for Boxes:
  - Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
     a. For exposed boxes in public areas, use only identification labels.
- E. Identification for Devices:
  - 1. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.

# 2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
  - 1. Materials:
    - a. Indoor Clean, Dry Locations: Use plastic nameplates.
    - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.

- 2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
- 3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
- 4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
- 5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.
- B. Identification Labels:
  - 1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
  - 2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
  - 1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
  - 2. Legend:
    - a. Equipment designation or other approved description.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height:
    - a. Equipment Designation: 1/2 inch (13 mm).
  - 5. Color:
    - a. Normal Power System: White text on black background.
- D. Format for General Information and Operating Instructions:
  - 1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
  - 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height: 1/4 inch (6 mm).
  - 5. Color: Black text on white background unless otherwise indicated.
- E. Format for Receptacle Identification:
  - 1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
  - 2. Legend: Power source and circuit number or other designation indicated.
    - a. Include voltage and phase for other than 120 V, single phase circuits.
  - 3. Text: All capitalized unless otherwise indicated.
  - Minimum Text Height: 3/16 inch (5 mm).
     Color: Black text on clear background.
- 2.03 WIRE AND CABLE MARKERS
  - A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
  - B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
  - C. Legend: Power source and circuit number or other designation indicated.
  - D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
  - E. Minimum Text Height: 1/8 inch (3 mm).
  - F. Color: Black text on white background unless otherwise indicated.

# 2.04 VOLTAGE MARKERS

- A. Minimum Size:
- B. Legend:
- C. Color: Black text on orange background unless otherwise indicated.
- 2.05 UNDERGROUND WARNING TAPE

- A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- B. Non-detectable Type Tape: 6 inches (152 mm) wide, with minimum thickness of 4 mil (0.1 mm).
- C. Legend: Type of service, continuously repeated over full length of tape.
- D. Color:
  - 1. Tape for Buried Power Lines: Black text on red background.

# 2.06 WARNING SIGNS AND LABELS

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
  - 1. Materials:
    - 2. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.
- C. Warning Labels:
  - 1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester, or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
  - 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
  - 3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

#### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
  - 1. Surface-Mounted Equipment: Enclosure front.
  - 2. Flush-Mounted Equipment: Inside of equipment door.
  - 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
  - 4. Elevated Equipment: Legible from the floor or working platform.
  - 5. Branch Devices: Adjacent to device.
  - 6. Interior Components: Legible from the point of access.
  - 7. Conduits: Legible from the floor.
  - 8. Boxes: Outside face of cover.
  - 9. Conductors and Cables: Legible from the point of access.
  - 10. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing, or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches (75 mm) below finished grade.
- G. Mark all handwritten text, where permitted, to be neat and legible.

## LIGHTING CONTROL DEVICES

PART 1 GENERAL

# 1.01 SECTION INCLUDES

A. Outdoor photo controls.

# PART 2 PRODUCTS

## 2.01 ALL LIGHTING CONTROL DEVICES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.
- 2.02 OUTDOOR PHOTO CONTROLS

## LOW-VOLTAGE TRANSFORMERS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

A. General purpose transformers.

## 1.02 RELATED REQUIREMENTS

- A. Section 03 3000 Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 0526 Grounding and Bonding for Electrical Systems.
- C. Section 26 0553 Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 0534 Conduit: Flexible conduit connections.

## 1.03 REFERENCE STANDARDS

- A. IEEE C57.94 Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type General Purpose Distribution and Power Transformers; 1982 (R2006).
- B. IEEE C57.96 Guide for Loading Dry-Type Distribution and Power Transformers; 1999 (R2004).
- C. NECA 1 Standard for Good Workmanship in Electrical Construction; 2010.
- D. NECA 409 Standard for Installing and Maintaining Dry-Type Transformers; 2009.
- E. NEMA ST 20 Dry-Type Transformers for General Applications; National Electrical Manufacturers Association; 1992 (R1997).
- F. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum); 2008
- G. NEMA TP 1 Guide for Determining Energy Efficiency for Distribution Transformers; 2002.
- H. NEMA TP 2 Standard Test Method for Measuring the Energy Consumption of Distribution Transformers; 2005.
- I. NEMA TP 3 Standard for the Labeling of Distribution Transformer Efficiency; 2000.
- J. NFPA 70 National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 506 Standard for Specialty Transformers; Current Edition, Including All Revisions.
- L. UL 1561 Standard for Dry-Type General Purpose and Power Transformers; Current Edition, Including All Revisions.

## 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with placement of support framing and anchors required for mounting of transformers.
- 1.05 SUBMITTALS
  - A. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.
  - B. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.
- 1.06 QUALITY ASSURANCE
  - A. Conform to requirements of NFPA 70.

# 1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

## PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Siemens Industry, Inc: www.sea.siemens.com.
- B. All new transformers shall be of the same manufacturer and as close to the same type as possible as the existing equipment in the traffic operations building.
- C. Source Limitations: Furnish transformers produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

#### 2.02 ALL TRANSFORMERS

- A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
  - 1. Altitude: Less than 3,300 feet (1,000 m).
  - 2. Ambient Temperature: Not exceeding 86 degrees F (30 degrees C) average or 104 degrees F (40 degrees C) maximum measured during any 24 hour period.
- C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.
- D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.
- E. Basic Impulse Level: 10 kV.
- F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- G. Isolate core and coil from enclosure using vibration-absorbing mounts.
- H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.
- 2.03 GENERAL PURPOSE TRANSFORMERS
  - A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.
  - B. Insulation System and Allowable Average Winding Temperature Rise:
    - 1. Less than 15 kVA: Class 185 degrees C insulation system with 115 degrees C average winding temperature rise.
    - 2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.
  - C. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.
  - D. Winding Taps:
    - 1. Less than 3 kVA: None.
    - 2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.

- 3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
- 4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.
- E. Energy Efficiency: Standard efficiency complying with NEMA TP 1.
  - 1. Test efficiency according to NEMA TP 2.
  - 2. Label transformer according to NEMA TP 3.
- F. Sound Levels: Standard sound levels complying with NEMA ST 20.
- G. Mounting Provisions:
  - 1. Larger than 75 kVA: Suitable for floor mounting.
- H. Transformer Enclosure: Comply with NEMA ST 20.
  - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
  - 2. Construction: Heavy gage steel.
  - a. 15 kVA and Larger: Ventilated.
  - 3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
  - 4. Provide lifting eyes or brackets.

### 2.04 SOURCE QUALITY CONTROL

A. Factory test transformers according to NEMA ST 20.

### PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.
- C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.
- D. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1.
- B. Install transformers in accordance with manufacturer's instructions.
- C. Install transformers in accordance with NECA 409 and IEEE C57.94.
- D. Use flexible conduit, under the provisions of Section 26 0534, 2 feet (600 mm) minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.
- F. Mount floor-mounted transformers on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 03 3000.
- G. Provide grounding and bonding in accordance with Section 26 0526.
- H. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.
- I. Where not factory-installed, install lugs sized as required for termination of conductors as shown on the drawings.

# 3.03 ADJUSTING

- A. Measure primary and secondary voltages and make appropriate tap adjustments.
- B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

# 3.04 CLEANING

- A. Clean dirt and debris from transformer components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

## PANELBOARDS

### PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Lighting and appliance panelboards.
- B. Overcurrent protective devices for panelboards.

### 1.02 RELATED REQUIREMENTS

- A. Section 26 0526 Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 Hangers and Supports for Electrical Systems.
- C. Section 26 0553 Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 2200 Low-Voltage Transformers: Small power centers with integral primary breaker, transformer, and panelboard.
- E. Section 26 2813 Fuses: Fuses for fusible switches and spare fuse cabinets.

## PART 2 PRODUCTS

### 2.01 ALL PANELBOARDS

- A. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose indicated.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet (2,000 m).
  - 2. Ambient Temperature:
    - a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
- C. Short Circuit Current Rating:
- D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
  - 1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
  - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
  - 2. Boxes: Galvanized steel unless otherwise indicated.
    - a. Provide wiring gutters sized to accommodate the conductors to be installed.
  - 3. Fronts:
    - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
    - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
  - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- 2.02 LIGHTING AND APPLIANCE PANELBOARDS
  - A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

- B. Conductor Terminations:
  - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
  - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
  - 2. Phase and Neutral Bus Material: Aluminum.
  - 3. Ground Bus Material: Aluminum.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
  - 1. Provide surface-mounted or flush-mounted enclosures as indicated.
  - 2. Provide clear plastic circuit directory holder mounted on inside of door.

## 2.03 OVERCURRENT PROTECTIVE DEVICES

- A. Molded Case Circuit Breakers:
  - 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
  - 2. Interrupting Capacity:
    - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
    - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
  - 3. Conductor Terminations:
    - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  - 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
  - 5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

## FEEDER AND PLUG-IN BUSWAY

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Indoor busway and fittings.
- B. Plug-in units.

#### 1.02 RELATED REQUIREMENTS

A. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

## 1.03 REFERENCE STANDARDS

- A. NEMA BU 1 Busways; National Electrical Manufacturers Association; 2002.
- B. NETA STD ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.
- C. NFPA 70 National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene prior to performing field measurements for busway fabrication drawings. Review proposed routing, sequence of installation, and protection requirements for installed busway.
- 1.05 SUBMITTALS
  - A. Shop Drawings: Indicate ratings, dimensions and finishes. Include dimensioned layout diagram, installation details and locations of supports and fittings such as firestops and weatherseals. Include details of wall and floor penetrations.
  - B. Product Data: Provide catalog data for components and plug-in units.
  - C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
  - D. Coordination Drawings: Indicate busway layout and support locations.
  - E. Project Record Documents: Record actual busway routing and location of plug-in units.
  - F. Maintenance Data: Include joint re-tightening schedule.

#### 1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect from moisture by using appropriate coverings. Store in dry interior locations.

## 1.08 FIELD CONDITIONS

- A. Do not install until building is closed in and suitable temperature conditions are controlled.
- B. Maintain suitable temperature and humidity conditions during and after installation of busway.

## PART 2 PRODUCTS

- 2.01 MANUFACTURERS
  - A. Eaton Corporation; Cutler-Hammer Products; Model \_\_\_\_\_: www.eaton.com.
  - B. General Electric Company; Model \_\_\_\_\_: www.geindustrial.com.
  - C. Schneider Electric; Square D Products; Model \_\_\_\_\_: www.schneider-electric.us.

## FEEDER AND PLUG-IN BUSWAY

### 2.02 INDOOR BUSWAY

- A. Plug-In Busway: NEMA BU 1, 3 phase, 4-wire low impedance plug-in busway rated 120/208 volts, 60 Hz. Plug-in openings on 24 inch (610 mm) centers each side, with hinged doors to protect opening where plug-in unit is not installed. Ampere ratings as indicated.
- B. Conductors: Copper bars, fully insulated except at joints, full neutral, insulated ground bus.
- C. Joints: Single bolt type, with silver-plated contact surface for bus and splice plate.
- D. Fittings: According to manufacturer's recommendations.
- E. Finish: Manufacturer's standard gray enamel.

### 2.03 PLUG-IN UNITS

- A. Feeder Units: Compatible with busway; enclosure with hinged door and externally-operatable handle for stick operation, lockable in OFF position; interlock to prevent opening front cover with switch in ON position; insulated grounding stab.
  - 1. Molded Case Thermal-Magnetic Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole; UL listed.
- B. Finish: Manufacturer's standard gray enamel.

### PART 3 EXECUTION

### 3.01 PREPARATION

- A. Verify that field measurements are as indicated on shop drawings.
- B. Sequence work to avoid interferences with building finishes and installation of other products.

### 3.02 INSTALLATION

- A. Tighten joints using a torque wrench, to manufacturer's specified values.
- B. Install busway length with expansion fitting at each location where busway run crosses building expansion joint.
- C. Mounting and Support: Mount horizontal busway runs in upright position. Support busway at maximum 10 feet (3000 mm) intervals as recommended by manufacturer. Support vertical riser at each floor.
- D. Install fuses in fused feeder switches.
- E. Identify busway in accordance with Section 26 0553.

#### 3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA STD ATS, except Section 4.
- B. Perform inspections and tests listed in NETA STD ATS, Section 7.4.

## ELECTRICAL CABINETS AND ENCLOSURES

# PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Hinged cover enclosures.
- B. Cabinets.

### 1.02 REFERENCE STANDARDS

- A. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2008.
- C. NFPA 70 National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

### 1.03 SUBMITTALS

- A. Product Data: Provide manufacturer's standard data for enclosures and cabinets.
- 1.04 QUALITY ASSURANCE
  - A. Conform to requirements of NFPA 70.

### PART 2 PRODUCTS

- 2.01 HINGED COVER ENCLOSURES
  - A. Construction: NEMA 250, Type 1 steel enclosure.
  - B. Covers: Continuous hinge, held closed by flush latch operable by screwdriver.
  - C. Provide interior plywood panel for mounting terminal blocks and electrical components; finish with white enamel.
  - D. Enclosure Finish: Manufacturer's standard enamel.

### PART 3 EXECUTION

## 3.01 INSTALLATION

- A. Install securely, in a neat and workmanlike manner, as specified in NECA 1.
- B. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner under the provisions of Section 26 0529.

## WIRING DEVICES

## PART 1 GENERAL

- 1.01 SECTION INCLUDES
  - A. Wall switches.
  - B. Receptacles.
  - C. Wall plates.

### 1.02 RELATED REQUIREMENTS

- A. Section 26 0526 Grounding and Bonding for Electrical Systems.
- B. Section 26 0537 Boxes.
- C. Section 26 0553 Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 2717 Equipment Wiring: Cords and plugs for equipment.

## 1.03 REFERENCE STANDARDS

- A. FS W-C-596 Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.
- B. FS W-S-896 Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification; Revision F, 1999.
- C. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- D. NEMA WD 1 General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005).
- E. NEMA WD 6 Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R2008).
- F. NFPA 70 National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 20 General-Use Snap Switches; Current Edition, Including All Revisions.
- H. UL 498 Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- I. UL 514D Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
- J. UL 943 Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
  - 2. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
  - 3. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.
- B. Sequencing:
  - 1. Do not install wiring devices until final surface finishes and painting are complete.

### 1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
- B. Operation and Maintenance Data:
   1. GFI Receptacles: Include information on status indicators and testing procedures and intervals.
- 1.06 QUALITY ASSURANCE
  - A. Conform to requirements of NFPA 70.

#### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Hubbell Incorporated; \_\_\_\_: www.hubbell-wiring.com.
- B. Leviton Manufacturing Company, Inc; \_\_\_\_\_: www.leviton.com.
- C. Pass & Seymour, a brand of Legrand North America, Inc; \_\_\_\_\_: www.legrand.us

## 2.02 APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFI receptacles with specified weatherproof covers for all receptacles installed outdoors or in damp or wet locations.
- D. Provide GFI protection for receptacles where indicated on plan.

## 2.03 ALL WIRING DEVICES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- B. Finishes:
  - 1. Wiring Devices Installed in Finished Spaces: White with white nylon wall plate unless otherwise indicated.
  - 2. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate unless otherwise indicated.
  - 3. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover unless otherwise indicated.

# 2.04 WALL SWITCHES

- A. Manufacturers:
  - 1. Hubbell Incorporated; \_\_\_\_: www.hubbell-wiring.com.
  - 2. Leviton Manufacturing Company, Inc; \_\_\_\_: www.leviton.com.
  - 3. Pass & Seymour, a brand of Legrand North America, Inc; \_\_\_\_\_: www.legrand.us
- B. All Wall Switches: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
  - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
- 2.05 RECEPTACLES
  - A. Manufacturers:
    - 1. Hubbell Incorporated; \_\_\_\_: www.hubbell-wiring.com.
    - 2. Leviton Manufacturing Company, Inc; \_\_\_\_\_: www.leviton.com.

- 3. Pass & Seymour, a brand of Legrand North America, Inc; \_\_\_\_\_: www.legrand.us
- B. All Receptacles: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
  - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
  - 2. NEMA configurations specified are according to NEMA WD 6.
- C. Convenience Receptacles:
  - 1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
- D. GFI Receptacles:
  - 1. All GFI Receptacles: Provide with feed-through protection, light to indicate ground fault tripped condition and loss of protection, and list as complying with UL 943, class A.
  - 2. Standard GFI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
  - 3. Weather Resistant GFI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

## 2.06 WALL PLATES

- A. Manufacturers:
  - 1. Hubbell Incorporated; \_\_\_\_: www.hubbell-wiring.com.
  - 2. Leviton Manufacturing Company, Inc; \_\_\_\_\_: www.leviton.com.
  - 3. Pass & Seymour, a brand of Legrand North America, Inc; \_\_\_\_\_: www.legrand.us
- B. All Wall Plates: Comply with UL 514D.
  - 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
  - 2. Size: Standard; \_\_\_\_\_
  - 3. Screws: Metal with slotted heads finished to match wall plate finish.
- C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
- D. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- E. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected.

#### PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- F. Verify that conditions are satisfactory for installation prior to starting work.

## 3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.
- 3.03 INSTALLATION
  - A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

## WIRING DEVICES

- B. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of wiring devices provided under this section.
  - 1. Mounting Heights: Unless otherwise indicated, as follows:
    - a. Wall Switches: 48 inches (1.2 m) above finished floor.
    - b. Receptacles: 18 inches (450 mm) above finished floor or 6 inches (150 mm) above counter.
  - 2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
  - 3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. Provide GFI receptacles with integral GFI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- I. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- J. Install wall switches with OFF position down.
- K. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- L. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- M. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

## 3.04 FIELD QUALITY CONTROL

- A. Inspect each wiring device for damage and defects.
- B. Operate each wall switch with circuit energized to verify proper operation.
- C. Test each receptacle to verify operation and proper polarity.
- D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- E. Correct wiring deficiencies and replace damaged or defective wiring devices.

## 3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- 3.06 CLEANING
  - A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

## FUSES

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

A. Fuses.

## 1.02 REFERENCE STANDARDS

- A. NEMA FU 1 Low Voltage Cartridge Fuses; National Electrical Manufacturers Association; 2002 (R2007).
- B. NFPA 70 National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 248-1 Low-Voltage Fuses Part 1: General Requirements; Current Edition, Including All Revisions.
- D. UL 248-12 Low-Voltage Fuses Part 12: Class R Fuses; Current Edition, Including All Revisions.

## 1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
  - 2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
  - 3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

## 1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

## PART 2 PRODUCTS

- 2.01 MANUFACTURERS
  - A. Cooper Bussmann, a division of Cooper Industries: www.cooperindustries.com.

## 2.02 APPLICATIONS

- A. Feeders:
  - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.

## 2.03 FUSES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose indicated.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.
- H. Provide the following accessories where indicated or where required to complete installation:
   1. Fuseholders: Compatible with indicated fuses.

## PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
- B. Verify that conditions are satisfactory for installation prior to starting work.

## 3.02 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

## ENCLOSED CIRCUIT BREAKERS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

A. Enclosed circuit breakers.

### 1.02 RELATED REQUIREMENTS

- A. Section 26 0526 Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 Hangers and Supports for Electrical Systems.
- C. Section 26 0553 Identification for Electrical Systems: Identification products and requirements.

#### 1.03 REFERENCE STANDARDS

- A. FS W-C-375 Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision D, 2006.
- B. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- C. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.
- D. NFPA 70 National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 50 Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- F. UL 50E Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- G. UL 489 Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

### 1.04 ADMINISTRATIVE REQUIREMENTS

#### A. Coordination:

- 1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
- 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
- 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
- 4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

# 1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.

#### 1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

### PART 2 PRODUCTS

## 2.01 ENCLOSED CIRCUIT BREAKERS

- A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.
- B. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose indicated.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service

# ENCLOSED CIRCUIT BREAKERS

conditions:

- 1. Altitude: Less than 6,600 feet (2,000 m).
- 2. Ambient Temperature: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
- D. Short Circuit Current Rating:
  - 1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location indicated on the drawings.
- E. Conductor Terminations: Suitable for use with the conductors to be installed.
- F. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.
- G. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
  1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
- H. Provide externally operable handle with means for locking in the OFF position.

## 2.02 MOLDED CASE CIRCUIT BREAKERS

- A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
- B. Interrupting Capacity:
  - 1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
  - 2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
- C. Conductor Terminations:
  - 1. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
- D. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install enclosed circuit breakers where indicated, in accordance with manufacturer's instructions.
- B. Install enclosed circuit breakers securely, in a neat and workmanlike manner in accordance with NECA 1.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required supports in accordance with Section 26 0529.
- E. Install enclosed circuit breakers plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 26 0526.

## 3.02 CLEANING

- A. Clean dirt and debris from circuit breaker enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

## ENCLOSED SWITCHES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Enclosed safety switches.

### 1.02 RELATED REQUIREMENTS

- A. Section 26 0526 Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 Hangers and Supports for Electrical Systems.
- C. Section 26 0553 Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 2813 Fuses.

### 1.03 REFERENCE STANDARDS

- A. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.
- C. NEMA KS 1 Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).
- D. NFPA 70 National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 50 Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- F. UL 50E Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- G. UL 98 Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  - 4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

## 1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
- 1.06 QUALITY ASSURANCE
  - A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Siemens Industry, Inc: www.sea.siemens.com.
- B. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.
- C. General Electric Company: www.geindustrial.com.
- D. Schneider Electric; Square D Products: www.schneider-electric.us.

### 2.02 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break, enclosed safety switches complying with NEMA KS 1, type HD (heavy duty), and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet (2,000 m).
  - 2. Ambient Temperature: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).
- D. Horsepower Rating: Suitable for connected load.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:
  - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
  - 2. Minimum Ratings:
    - a. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
- G. Provide with switch blade contact position that is visible when the cover is open.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- J. Enclosures: Comply with NEMA KS 1 and NEMA 250, and list and label as complying with UL 50 and UL 50E.
  - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
- K. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- L. Heavy Duty Switches:
  - 1. Conductor Terminations:
    - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  - 2. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

## PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install enclosed switches in accordance with manufacturer's instructions.
- B. Install enclosed switches securely, in a neat and workmanlike manner in accordance with NECA 1.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required supports in accordance with Section 26 0529.
- E. Install enclosed switches plumb.

- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 26 0526.

# 3.02 CLEANING

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

## INTERIOR LIGHTING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Exit signs.
- C. Ballasts.
- D. Lamps.
- E. Luminaire accessories.

#### 1.02 RELATED REQUIREMENTS

- A. Section 26 0537 Boxes.
- B. Section 26 2726 Wiring Devices: Manual wall switches and wall dimmers.

## 1.03 REFERENCE STANDARDS

- A. ANSI C82.11 American National Standard for Lamp Ballasts High Frequency Fluorescent Lamp Ballasts Supplements; Consolidated-2002.
- B. IEEE C62.41.2 Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (R2008).
- C. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- D. NECA/IESNA 500 Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; 2006.
- E. NECA/IESNA 502 Standard for Installing Industrial Lighting Systems; National Electrical Contractors Association; 2006.
- F. NFPA 70 National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. NFPA 101 Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2009.
- H. UL 935 Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.
- I. UL 1598 Luminaires; Current Edition, Including All Revisions.

## 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
  - 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
  - 3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
  - 4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. Shop Drawings:
  - 1. Indicate dimensions and components for each luminaire that is not a standard product of the

## INTERIOR LIGHTING

#### manufacturer.

- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
  - 1. Ballasts: Include wiring diagrams and list of compatible lamp configurations.
  - 2. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

### 1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

### PART 2 PRODUCTS

- 2.01 LUMINAIRE TYPES
  - A. Furnish products as indicated in luminaire schedule included on the drawings.

### 2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

### 2.03 EXIT SIGNS

- A. All Exit Signs: Internally illuminated with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
  - 1. Number of Faces: Single or double as indicated or as required for the installed location.
  - 2. Directional Arrows: As indicated or as required for the installed location.

#### 2.04 BALLASTS

- A. All Ballasts:
  - 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
  - 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
- B. Fluorescent Ballasts:
  - 1. All Fluorescent Ballasts: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935.

- a. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
- b. Total Harmonic Distortion: Not greater than 20 percent.
- c. Power Factor: Not less than 0.95.
- d. Thermal Protection: Listed and labeled as UL Class P, with automatic reset for integral thermal protectors.
- e. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
- f. Lamp Compatibility: Specifically designed for use with the specified lamp, with no visible flicker.
- g. Lamp Operating Frequency: Greater than 20 kHz, except as specified below.
- h. Lamp Current Crest Factor: Not greater than 1.7.
- i. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.
- j. Provide end of lamp life automatic shut down circuitry for T5 and smaller diameter lamp ballasts.
- k. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.
- I. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 18, for Class A, non-consumer application.
- m. Ballast Marking: Include wiring diagrams with lamp connections.

### 2.05 LAMPS

- A. Manufacturers:
  - 1. General Electric Company/GE Lighting; \_\_\_\_\_: www.gelighting.com.
  - 2. Osram Sylvania; \_\_\_\_\_: www.sylvania.com.
  - 3. Philips Lighting Company; \_\_\_\_\_: www.lighting.philips.com.
  - 4. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.
  - 5. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.
- B. All Lamps:
  - 1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
  - 2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
  - 3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
  - 4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.
- C. Compact Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
  - 1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
  - 2. Color Rendering Index (CRI): Not less than 80.
  - 3. Average Rated Life: Not less than 10,000 hours for an operating cycle of three hours per start.
- D. Linear Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
  - 1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
  - 2. T8 Linear Fluorescent Lamps:
    - a. Color Rendering Index (CRI): Not less than 80.
    - b. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.
- 2.06 ACCESSORIES
- PART 3 EXECUTION
- 3.01 EXAMINATION
  - A. Verify that field measurements are as shown on the drawings.
  - B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

## DTO - COMMAND VEHICLE STORAGE

- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

## 3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

### 3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship), NECA 500 (commercial lighting), and NECA 502 (industrial lighting).
- D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- E. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- F. Install accessories furnished with each luminaire.
- G. Bond products and metal accessories to branch circuit equipment grounding conductor.
- H. Exit Signs:
  - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- I. Install lamps in each luminaire.
- 3.04 CLEANING
  - A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

## 3.05 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

# SECTION 28 3100

## FIRE DETECTION AND ALARM

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Circuits from protected premises to supervising station, including conduit.
- B. Extension and additions to existing fire alarm system components, wiring, and conduit indicated.

## 1.02 REFERENCE STANDARDS

- A. IEEE C62.41.2 Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits; 2002 (R2008).
- B. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NFPA 72 National Fire Alarm Code and Signaling Code; 2010.
- D. NFPA 101 Code for Safety to Life from Fire in Buildings and Structures; 2009.

### 1.03 SUBMITTALS

- A. Evidence of designer qualifications.
- B. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
  - 1. Copy (if any) of list of data required by authority having jurisdiction.
  - 2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
  - 3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
  - 4. System zone boundaries and interfaces to fire safety systems.
  - 5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
  - 6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
  - 7. List of all devices on each signaling line circuit, with spare capacity indicated.
  - 8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
  - 9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
  - 10. Do not show existing components to be removed.
- C. Evidence of installer qualifications.
- D. Inspection and Test Reports:
  - 1. Submit inspection and test plan prior to closeout demonstration.
  - 2. Submit documentation of satisfactory inspections and tests.
  - 3. Submit NFPA 72 "Inspection and Test Form," filled out.
- E. Operating and Maintenance Data: See Section 01 7800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
  - 1. Complete set of specified design documents, as approved by authority having jurisdiction.
  - 2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
  - 3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
  - 4. List of recommended spare parts, tools, and instruments for testing.
  - 5. Replacement parts list with current prices, and source of supply.
  - 6. Detailed troubleshooting guide and large scale input/output matrix.
  - 7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
  - 8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

- F. Project Record Documents: See Section 01 7800 for additional requirements; have one set available during closeout demonstration:
  - 1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
  - 2. "As installed" wiring and schematic diagrams, with final terminal identifications.
  - 3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
- G. Closeout Documents:
  - 1. Certification by manufacturer that the system has been installed in compliance with his installation requirements, is complete, and is in satisfactory operating condition.
  - 2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
- 1.04 QUALITY ASSURANCE
  - A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.
  - B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
    - 1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
    - 2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
    - 3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.

## PART 2 PRODUCTS

## 2.01 MANUFACTURERS

- A. Initiating Devices, and Notification Appliances:
  - 1. Same manufacturer as control units.
  - 2. Provide all initiating devices and notification appliances made by the same manufacturer.

## 2.02 FIRE ALARM SYSTEM

- A. Fire Alarm System: Provide modifications and extensions to the existing automatic fire detection and alarm system:
  - 1. Provide all components necessary, regardless of whether shown in the contract documents or not.
  - 2. Protected Premises: Entire building shown on drawings.
  - 3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
    - a. The Americans With Disabilities Act (ADA).
    - b. The requirements of the State Fire Marshal.
    - c. The requirements of the local authority having jurisdiction.
    - d. Applicable local codes.
    - e. The contract documents (drawings and specifications).
    - f. NFPA 101.
    - g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.

- 4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
- 5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
- 6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
- 7. Program notification zones and voice messages as directed by Owner.
- 8. Master Control Unit (Panel): Existing, located in the Main Building\_\_\_\_\_.
- B. Supervising Stations and Fire Department Connections:
  - 1. Public Fire Department Notification: By on-premises supervising station.
  - 2. On-Premises Supervising Station: Existing proprietary station operated by Owner, located at
- C. Power Sources:
  - 1. Primary: Dedicated branch circuits of the facility power distribution system.
  - 2. Secondary: Storage batteries.
  - 3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
  - 4. Each Computer System: Provide uninterruptible power supply (UPS).

#### 2.03 EXISTING COMPONENTS

- A. On-Premises Supervising Station: Include as part of this work all modifications necessary to existing supervising station to accommodate new fire alarm work.
- B. Clearly label components that are "Not In Service."
- C. Remove unused existing components and materials from site and dispose of properly.

### 2.04 COMPONENTS

- A. General:
  - 1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
  - 2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.
- B. Fire Alarm Control Units, Initiating Devices, and Notification Appliances: Analog, addressable type; listed by Underwriters Laboratories as suitable for the purpose intended.
- C. Circuit Conductors: Copper or optical fiber; provide 200 feet (60 m) extra; color code and label.
- D. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
- E. Locks and Keys: Deliver keys to Owner.

#### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and the contract documents.
- B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- C. Obtain Owner's approval of locations of devices, before installation.
- D. Install instruction cards and labels.

## 3.02 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- E. Provide all tools, software, and supplies required to accomplish inspection and testing.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

## 3.03 CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
  - 1. Be prepared to conduct any of the required tests.
  - 2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
  - 3. Have authorized technical representative of control unit manufacturer present during demonstration.
  - 4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
  - 5. Repeat demonstration until successful.

# SECTION 311000 - CLEARING

# PART 1 GENERAL

## 1.01 DESCRIPTION

- A. Work included: Clearing, grubbing, removing and disposing of all vegetation and debris within work limits and from borrow pits, and such other areas as required, except objects designated to remain or to be removed. Also includes preservation from injury or defacement of all vegetation and objects designated to remain.
- B. Related Work:
  - 1. Section 311001 Earthwork: Site Grading

# 1.02 SUBMITTALS

- A. Permits: If required, furnish copies of permits.
  - 1. Fugitive Dust
  - 2. Over-lot Grading

# 1.03 JOB CONDITIONS

- A. Protection: Protect trees, shrubs and planted areas to remain from damage or from unnecessary vehicular traffic, in manner acceptable to Engineer. Protect benchmarks, staking, existing structures, roads, sidewalks, paving, and curbs from damage. Maintain designated temporary roadways, walkways, and detours. Burning is not permitted.
- B. All excavation equipment must be kept clean and free of weeds.

# PART 2 PRODUCTS

- 2.01 TREE WOUND PAINT
  - A. Asphaltum-based paint prepared for tree surgery.

## PART 3 EXECUTION

# 3.01 CLEARING

A. Clear and/or grub all surface objects and all trees, stumps, roots, and other protruding

obstructions, not designated to remain. Includes mowing, as required. Leave undisturbed stumps and roots and nonperishable solid objects in areas where topsoil is not required to be removed. When authorized, leave stumps and nonperishable solid objects, provided they do not extend more than 6" above ground line or low water level, except in areas to be rounded at top of back slopes.

B. Paint cut or scarred surfaces of trees or shrubs selected for retention with tree wound paint.

# 3.02 DISPOSAL

A. Deposit all waste material in designated waste areas. Grade and shape disposal site. Complete topsoil and reseed site if required. Where disposal sites are not designated, remove and dispose of all waste materials off site.

# SECTION 311001 – EARTHWORK

## PART 1 GENERAL

## 1.01 DESCRIPTION

- A. Work Included:
  - 1. Preparing of subgrade for building slabs, walks, and pavements.
- B. Related Work
  - 1. Section 02100 Clearing
  - 2. Section 01000 Dig Permits

## 1.02 DEFINITIONS

- A. Excavation consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.
- B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor's expense.
- C. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular subbase, drainage fill, or topsoil materials.

## 1.03 SUBMITTALS

- A. Test Reports: Submit the following reports directly to Engineer from the testing services, with copy to Contractor:
  - 1. Test reports on borrow material.
  - 2. Field reports; in-place soil density tests.
  - 3. One optimum moisture-maximum density curve for each type of soil encountered.
  - 4. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

## 1.04 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

B. Testing and Inspection Service: Contractor will employ and pay for a qualified independent geotechnical testing and inspection laboratory to perform soil testing and inspection service during earthwork operations.

### 1.05 JOB CONDITIONS

- A. Site Information: Data in subsurface investigation reports was used for the basis of the design and are available to the Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.
  - 1. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.
- B. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
  - 1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
  - 2. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Engineer and then only after acceptable temporary utility services have been provided.
    - a) Provide minimum of 2 weeks notice to Engineer, and receive written notice to proceed before interrupting any utility.
- C. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.
  - 1. Operate warning lights as recommended by authorities having jurisdiction.
  - 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

## PART 2 PRODUCTS

#### 2.01 SOIL MATERIALS

- A. Soils Materials, whether from sources on or off site must be approved by the Soils Engineer as suitable for intended use and specifically for required location or purpose.
- B. Provide non-expansive, cohesive soil from off-site sources approved by the Soils Engineer. See approved Geotechnical Engineering Report.
- C. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2 inch sieve and not more than 5 percent passing a No. 4 sieve.

D. Backfill and Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.

## PART 3 EXECUTION

## 3.01 EXCAVATION

- A. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.
- B. Excavation Classifications: The following classifications of excavation will be made when rock is encountered:
  - Earth Excavation includes excavation of pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.
  - 2. Rock excavation for trenches and pits includes removal and disposal of materials and obstructions encountered that cannot be excavated with a track-mounted power excavator, equivalent to Caterpillar Model No. 215C LC, and rated at not less than 115 HP flywheel power and 32,000-pound drawbar pull and equipped with a short stick and a 42-inch wide, short tip radius rock bucket rated at 0.81 cubic yard (heaped) capacity. Trenches in excess of 10 feet in width and pits in excess of 30 feet in either length or width are classified as open excavation.
  - 3. Rock excavation in open excavations includes removal and disposal of materials and obstructions encountered that cannot be dislodged and excavated with modern, track-mounted, heavy- duty excavating equipment without drilling, blasting, or ripping. Rock excavation equipment is defined as Caterpillar Model No. 973 or equivalent track-mounted loader, rated at not less than 210 HP flywheel power and developing minimum of 45,000-pound breakout force (measured in accordance with SAE J732).
    - a) Typical of materials classified as rock are boulders 1/2 cu. yd. or more in volume, solid rock, rock in ledges, and rock- hard cementitious aggregate deposits.
    - b) Intermittent drilling, blasting, or ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation.
    - C) Do not perform rock excavation work until material to be excavated has been crosssectioned and classified by Engineer. Such excavation will be paid on basis of Contract Conditions relative to change in work.
    - d) Rock payment lines are limited to the following:
      - i) Two feet outside of concrete work for which forms are required, except footings.
      - ii) One foot outside perimeter of footings.
      - iii) In pipe trenches, 6 inches below invert elevation of pipe and 2 feet wider than inside diameter of pipe, but not less than 3 feet minimum trench width.

- iv) Outside dimensions of concrete work where no forms are required.
- v) Under slabs on grade, 6 inches below bottom of concrete slab.

## 3.02 STABILITY OF EXCAVATIONS

- A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.
- B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.
  - Provide permanent steel sheet piling or pressure-creosoted timber sheet piling wherever subsequent removal of sheet piling might permit lateral movement of soil under adjacent structures. Cut off tops a minimum of 2'-6" below final grade and leave permanently in place.

## 3.03 DEWATERING

- A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
- B. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
- C. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

## 3.04 STORAGE OF EXCAVATED MATERIALS

- A. Stockpile excavated materials acceptable for backfill and fill where directed. Place, grade, and shape stockpiles for proper drainage.
- B. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
- C. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill.

## 3.05 EXCAVATION FOR STRUCTURES

- A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection.
- B. Excavations for footings and foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.
- C. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection. Do not disturb bottom of excavations, intended for bearing surface.

## 3.06 EXCAVATION FOR PAVEMENTS

- A. Cut surface under pavements to comply with cross-sections, elevations and grades as indicated.
- B. Prior to placing a new pavement section, the entire subgrade area should be over excavated to a depth of 2 feet.

### 3.07 TRENCH EXCAVATION FOR PIPES AND CONDUIT

- A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches of clearance on both sides of pipe or conduit.
- B. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- C. Where rock is encountered, carry excavation 6 inches below required elevation and backfill with a 6-inch layer of crushed stone or gravel prior to installation of pipe.
- D. For pipes or conduit less than 6 inches in nominal size, and for flat- bottomed, multiple-duct conduit units, do not excavate beyond indicated depths. Hand-excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
- E. For pipes and equipment 6 inches or larger in nominal size, shape bottom of trench to fit bottom of pipe for 90 degrees (bottom 1/4 of the circumference). Fill depressions with tamped sand backfill. At each pipe joint, dig bell holes to relieve pipe bell of loads. Ensure continuous bearing of pipe barrel on bearing surface.

## 3.08 COLD WEATHER PROTECTION

- A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.
- 3.09 BACKFILL AND FILL

- A. General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.
  - 1. Under grassed areas, use satisfactory excavated or borrow material.
  - 2. Under walks and pavements, use subbase material, satisfactory excavated or borrow material, or a combination.
  - 3. Under steps, use subbase material.
  - 4. Under building slabs, use drainage fill material.
  - 5. Under piping and conduit and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation. Shape excavation bottom to fit bottom 90 degrees of cylinder.
  - 6. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings, and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.
    - a) Concrete is specified in Division 3.
    - b) Do not backfill trenches until tests and inspections have been made and backfilling is authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.
  - 7. Provide 4-inch-thick concrete base slab support for piping or conduit less than 2'-6" below surface of roadways. After installation and testing of piping or conduit, provide minimum 4-inch-thick encasement (sides and top) of concrete prior to backfilling or placement of roadway subbase.
- B. Backfill excavations as promptly as work permits, but not until completion of the following:
  - 1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
  - 2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
  - 3. Removal of concrete formwork.
  - 4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
  - 5. Removal of trash and debris from excavation.
  - 6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

#### 3.10 PLACEMENT AND COMPACTION

A. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

- 1. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.
- B. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand- operated tampers.
- C. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- D. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.
- E. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Engineer if soil density tests indicate inadequate compaction.
  - 1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density, in accordance with ASTM D698
    - a) Under building slabs and steps, and pavements, compact 3 feet of subgrade and each layer of backfill or fill material at 95 percent maximum density.
    - b) Under lawn or unpaved areas, compact top 6 inches of subgrade and each layer of backfill or fill material at 90 percent maximum density.
    - c) Under walkways, compact top 6 inches of subgrade and each layer of backfill or fill material at 95 percent maximum density.
  - Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
    - a) Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
    - b) Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

## 3.11 GRADING

- A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.
- B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as

follows:

- 1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
- 2. Walks: Shape surface of areas under walks to line, grade, and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.
- 3. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.
- C. Grading Surface of Fill under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2 inch when tested with a 10-foot straightedge.
- D. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

## 3.12 PAVEMENT SUBBASE COURSE

- A. General: Subbase course consists of placing subbase material, in layers of specified thickness, over subgrade surface to support a pavement base course.
  - 1. Refer to other Division 2 sections for paving specifications.
- B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.
- C. Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each subbase course layer. Compact and roll at least a 12-inch width of shoulder simultaneous with the compaction and rolling of each layer of subbase course.
- D. Placing: Place subbase course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.
  - 1. When a compacted subbase course is indicated to be 6 inches thick or less, place material in a single layer. When indicated to be more than 6 inches thick, place material in equal layers, except no single layer more than 6 inches or less than 3 inches in thickness when compacted.

#### 3.13 BUILDING SLAB DRAINAGE COURSE

- A. General: Drainage course consists of placement of drainage fill material, in layers of indicated thickness, over subgrade surface to support concrete building slabs.
- B. Placing: Place drainage fill material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.
  - 1. When a compacted drainage course is indicated to be 6 inches thick or less, place material in a single layer. When indicated to be more than 6 inches thick, place material in equal layers, except no single layer more than 6 inches or less than 3 inches in thickness when compacted.

# 3.14 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction: Allow testing service to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.
  - 1. Perform field density tests in accordance with ASTM D 1556 (sand cone method) or ASTM D 2167 (rubber balloon method), as applicable.
    - a) Field density tests may also be performed by the nuclear method in accordance with ASTM D 2922, providing that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. In conjunction with each density calibration check, check the calibration curves furnished with the moisture gages in accordance with ASTM D 3017.
    - b) If field tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Engineer.
  - 2. Footing Subgrade: For each strata of soil on which footings will be placed, perform at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata when acceptable to Engineer.
  - 3. Paved Areas and Building Slab Subgrade: Perform at least one field density test of subgrade for every 2,000 sq. ft. of paved area or building slab, but in no case fewer than three tests. In each compacted fill layer, perform one field density test for every 2,000 sq. ft. of overlaying building slab or paved area, but in no case fewer than three tests.
  - 4. Foundation Wall Backfill: Perform at least two field density tests at locations and elevations as directed.
  - 5. If in opinion of Engineer, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, perform additional compaction and testing until specified density is obtained.

# 3.15 EROSION CONTROL

A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction.

# 3.16 MAINTENANCE

- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.
- D. Settling: Where settling is measurable or observable at excavated areas during general project

warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

END OF SECTION 02200

# DTO - COMMAND VEHICLE STORAGE

# SECTION 312000 - TRENCHING BACKFILLING, COMPACTING

# PART 1 GENERAL

### 1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1-Specification sections, apply to work of this Section.

### 1.02 SECTION INCLUDES

- A. Trenching, backfilling and compacting in connection with the construction of underground utilities and appurtenances shown on the drawings for work outside of building lines.
- B. Pavement removal and replacement.

### 1.03 RELATED SECTIONS:

- A. The following Sections contain requirements that relate to this Section:
  - 1. Section 311001 Earthwork
  - 2. Section 334100 Storm and Sanitary Sewer Systems

#### 1.04 SUBMITTALS

- A. Test Reports:
  - 1. Submit laboratory gradation tests for bedding and trench stabilization materials.

#### 1.05 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
  - 1. Perform excavation work in conformance to the requirements of authorities having jurisdiction. Supply, install, and remove all shoring as may be required to comply with all safety regulations and to maintain earth banks until backfill is placed.
- B. Testing and Inspection:
  - 1. Conform testing and inspection of backfill to the requirements of Section 311001. Make in place density tests at intervals and locations as directed by the Architect.

# 1.06 PROJECT/SITE CONDITIONS

- A. Protection:
  - 1. Protect existing utilities, adjacent property, and utility excavations, including hand excavation, in accordance with the requirements of Section 334100.
- B. Site Information:
  - 1. Soil Investigation and test reports are available for examination as set forth in Section 02010.
  - 2. Additional test borings and other exploratory operations may be made by the Contractor at no cost to the Owner.

## PART 2 PRODUCTS

- 2.01 SOIL MATERIALS
  - A. Fill Materials:
    - 1. Approved earth, loam, sandy clay, sand and gravel, soft shale, or other acceptable materials, free from organic matter and large clods of earth or stone, and of a proper moisture content which will facilitate backfilling.
  - B. Select Backfill:
    - 1. Suitable material with no stones greater than 1" diameter for concrete pipe and 0.75" diameter for all other pipe. Excavated material which meets the grading requirement may be used for select backfill.
  - C. Bedding Materials:
    - 1. The pipe shall be carefully bedded as shown in the bedding details.
    - 2. Provide Class "B" minimum bedding for PVC sanitary sewer pipe and Class "C" minimum bedding for all other pipe except as indicated otherwise.
      - a) Class B Bedding (Granular Foundation): Class B bedding is defined as that method of bedding in which the pipe is set on compacted granular material supporting the lower 1/2 of the pipe barrel.
        - i) Compacted Granular Material: Compacted granular material shall be a well graded gravelly material meeting the following requirements and compacted to 90% of maximum dry density as determined by ASTM D698.

| Square Mesh Sieve Size | Total Passing by Sizes (%) by Weight |
|------------------------|--------------------------------------|
| 1"                     | 100                                  |
| 3/4"                   | 90 to 100                            |
| 3/8"                   | 20 to 55                             |
| #4                     | 0 to 10                              |
| #8                     | 0 to 5                               |

b) Class C Bedding (Granular Foundation): Class C bedding is defined as that method of bedding in which the pipe is set on compacted granular material supporting the lower quadrant of the pipe barrel using uniform graded material as described under Class B bedding.

- c) Ductile Iron Pipe Bedding: Excavated material from work with no stones larger than 2" diameter, free from organic materials, chunks of soil, frozen material, debris or other unsuitable materials.
- d) Trench Stabilizing Material: Trench stabilizing material shall consist of 1/5" diameter washed rock.
- D. Unsuitable Material:
  - 1. Highly organic soil; ASTM D2487 Group PT, topsoil, roots, vegetable matter, trash and debris.

# PART 3 EXECUTION

# 3.01 EXCAVATION

- A. General:
  - 1. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
    - a) For Class "B" and "C" bedding, excavate to a depth below pipe invert equal to 1/8 of outside pipe diameter but not less than 6".
  - 2. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
- B. Excavation Classifications:
  - 1. All excavation is to be considered as "unclassified."
- C. Shoring and Bracing:
  - 1. Provide materials for shoring and bracing, such as sheet piling, up rights, stringers and crossbraces, in good serviceable condition. Provide shoring as required for safety and by governing authorities.
  - 2. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
  - 3. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses. Arrange shoring and bracing so as not to place stress on completed work.
  - 4. Exercise care in removal of shoring and bracing to prevent collapse or caving of excavation faces.
- D. Dewatering:
  - 1. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding areas.
  - 2. Do not allow water to accumulate in excavations. Remove water to prevent softening of trench bottoms, and soil changes detrimental to stability of subgrades and foundations.

- 3. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
- 4. Convey water removed from excavations and rain water to collecting or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure.
- 5. Do not use pipe or pipe trench excavations as temporary drainage ditches.
- E. Cold Weather Protection:
  - 1. Protect excavation bottoms against freezing when atmospheric temperature is less than 35LIF.
- F. Material Storage:
  - 1. Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.
  - 2. Locate and retain soil materials away from edge of excavations by at least two feet.
- G. Trenching:
  - Excavate trenches through all materials encountered to depths shown on drawings. Dispose of excavated materials not suitable for backfill as directed by Architect. From a point 1' above the top of pipe to the bottom of the trench, limit maximum trench width to the outside barrel diameter, plus 2'. Maintain minimum trench width to not be less than the outside barrel diameter, plus 1'.
  - 2. Excavate for manholes, vaults and other appurtenances with clearances between 12" and 24" on all sides.
  - 3. Do not excavate below required levels unless necessary due to wet trench conditions, as determined by the Architect. Backfill unnecessary excavation below the required level with granular bedding material as directed by the Architect and thoroughly tamp.
- H. Bedding:
  - 1. Bed pipe as shown in the bedding details. Provide Class "C" bedding except for PVC sanitary sewer pipe provide Class "B" bedding unless otherwise required by the Architect.
    - a) Class B Bedding (Granular Foundation): Set pipe on compacted granular material supporting the lower 1/2 of the pipe barrel.
    - b) Class C Bedding (Granular Foundation): Set pipe on compacted granular material supporting the lower quadrant of the pipe barrel.
    - c) Class B Bedding over and around the sides of the pipe to a minimum of at least 6".

# 3.02 CONTROLLED FILL

A. After pipe bedding has been completed in accordance with applicable pipeline sections, carefully backfill trenches using approved excavated materials. Carefully hand tamp around the pipe and up to 24" above the top of the pipe, in lifts not to exceed 6" loose thickness.

- B. Use care to place and tamp this course without disturbing joints, alignment, or grade of the piping. Fill remainder of trench in layers not exceeding 8" loose depth where pneumatic, vibratory or other hand tamping equipment is used.
- C. Where crane operated or hydraulic drop hammers are used to compact the remainder of the backfill, limit loose depth of each lift to 3'.
- D. Use care in backfilling and compacting operations to avoid disturbing pipe. Replace misaligned, crushed or otherwise disturbed main piping.
- E. Exercise extreme care in removing cribbing, shoring or sheeting so as not to disturb foundation, bedding and initial backfill. Where necessary to drive sheet piling or shoring below top of pipe, cut off sheet piling or shoring 1' above top of pipe and leave in place.
- F. Where groundwater or wet trench conditions occur, provide additional bedding below and over the pipe consisting of granular bedding material, as defined in pipe line sections, to a depth as required. If used, payment for the bedding materials shall be only for the additional amount in excess of the standard bedding requirements specified.
- G. Re-open trenches improperly backfilled, or where settlement occurs, to the depth required for proper compacting, then refill and compact, restoring the surface to the required grade, compaction, and smoothness.
- H. Pooling or water flooding for consolidating the backfill will not be permitted, and the addition of water is limited to that needed for obtaining the desired moisture content specified.

## 3.03 PAVEMENT REMOVAL AND REPLACEMENT

A. Score existing surface with a cutting wheel to create clean break line. Remove and dispose of existing surface and aggregate base course. Leave 6" undisturbed subgrade lip on each side of trench. After trench has been backfilled and properly compacted, place aggregate base course in accordance with permit requirements or minimum thickness specified. Compact aggregate base course to 95% AASHTO T180. Replace pavement in accordance with permit requirements or minimum thickness specified. Compact aggregate or minimum thickness specified. Compact aggregate base course to 95% AASHTO T180. Replace pavement in accordance with permit requirements or minimum thickness specified. Compact asphalt to 95% ASTM D1559.

## 3.04 FIELD QUALITY CONTROL

- A. Soil Compaction Tests:
  - 1. Determine maximum density and optimum moisture content of backfill material in accordance with ASTM D698.
  - 2. Moisture Content: Adjust and maintain moisture content of the soil within ±2% of optimum moisture content.
- B. Compaction Requirements:
  - 1. Compact backfill under paved areas or areas to be paved to not less than 95% maximum density from the top of the granular bedding to pavement base or subgrade.
  - 2. Compact backfill outside a traveled right-of-way to not less than 90% of maximum density from the top of the granular bedding to the ground surface or grade as set by the Architect.

- 3. Replace disturbed surface materials with material matching existing and adjacent materials.
- 4. Nuclear CRV's used for compaction will require a certified user and clearance from the base prior to access or use.

# END SECTION 312000

# SECTION 31 2316.13

## TRENCHING

### PART 1 GENERAL

- 1.01 SECTION INCLUDES
  - A. Backfilling and compacting for utilities outside the building.
- 1.02 REFERENCES
  - A. AASHTO T 180 Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2010.
  - B. ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2007.
  - C. ASTM D1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
  - D. ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2009.
  - E. ASTM D2167 Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.
  - F. ASTM D3017 Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.

# PART 3 EXECUTION

2.01 EXAMINATION

#### 2.02 TRENCHING

- A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- B. Slope banks of excavations deeper than 4 feet (1.2 meters) to angle of repose or less until shored.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Cut trenches wide enough to allow inspection of installed utilities.
- E. Hand trim excavations. Remove loose matter.
- F. Remove excavated material that is unsuitable for re-use from site.
- G. Remove excess excavated material from site.

#### 2.03 PREPARATION FOR UTILITY PLACEMENT

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

#### 2.04 BACKFILLING

- A. Backfill to contours and elevations indicated using unfrozen materials.
- B. Employ a placement method that does not disturb or damage other work.
- C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- D. Maintain optimum moisture content of fill materials to attain required compaction density.
- E. Slope grade away from building minimum 2 inches in 10 ft (50 mm in 3 m), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

- F. Correct areas that are over-excavated.
  - 1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.
- G. Compaction Density Unless Otherwise Specified or Indicated:
- H. Reshape and re-compact fills subjected to vehicular traffic.
- 2.05 BEDDING AND FILL AT SPECIFIC LOCATIONS
- 2.06 FIELD QUALITY CONTROL
  - A. See Section 01 4000 Quality Requirements, for general requirements for field inspection and testing.
  - B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D3017, or ASTM D6938.
  - C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.
  - D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

END OF SECTION

# DTO - COMMAND VEHICLE STORAGE

# SECTION 312319 - EROSION AND SEDIMENT CONTROL

# PART 1 GENERAL

# 1.01 DESCRIPTION

- A. Work Included:
  - 1. Temporary measures needed to control erosion and water pollution by use of berms, sediment basin and /or traps, hay bales, silt fences, surface roughing, mats and nets, curb socks, aggregate, riprap, vehicle tracking control, mulch, grasses, slope drains, and other approved measures at the locations necessary to control erosion and water pollution.
- B. Related Work:
  - 1. Clearing: Section 311000
  - 2. Earthwork: Section 311001

# 1.02 REFERENCES

A. "Urban Drainage and Flood Control Manual, Volume 3, Best Management Practices", Urban Drainage and Flood Control District.

#### 1.03 SUBMITTALS

- A. Schedule: Prepare schedules for accomplishing all required temporary and permanent erosion control work and submit them for acceptance at the pre-construction conference. Include all construction activities within the project, haul roads, borrow pits, storage and plate sites, and the plan for disposal of waste material. Do not start work until temporary erosion control schedules have been accepted.
- B. Permits: Obtain all necessary permits as set forth in Section 013300. Submit any proposed changes to the permits for approval prior to doing the work.

## 1.04 QUALITY ASSURANCE

- A. Pre-construction Conference: Contractor to assign an Erosion Control/ Water Quality Supervisor whose responsibility will be to fulfill the obligations listed below.
  - 1. Have authority over all necessary labor and equipment to direct and channel new drainages which may develop on a daily basis into a suitable temporary pollution and erosion control features wherever necessary during unforeseen or emergency situations, and of dismantling those features when their purpose has been fulfilled unless the C.O. directs that the facility be left in place as a permanent control feature. If removed, the area in which these features were constructed shall be returned to a condition reasonably similar to that which existed prior to its disturbance.
  - 2. Be immediately available upon the C.O.'s request to implement necessary actions to reduce any anticipated or presently existing water quality or erosion problems resulting from construction activities. The criteria by which the C.O. initiates this action may be based on

water quality data derived from monitoring operations or by anticipated conditions which the C.O. believes could lead to unsuitable water quality situations.

- 3. Give high priority to actions deemed necessary by the C.O. to control adverse water quality impacts. The erosion control/water quality supervisor, must make immediately available all personnel and equipment judged appropriate by the C.O. to maintain suitable erosion control features. These actions requested by the C.O. take precedence over any other aspect of the project construction which has need of the same manpower and equipment.
- 4. Sample water and provide the appropriate reports of analytical test results on the water sampled, or hire a qualified firm approved by the C.O. to perform the sampling and testing of water samples at the locations and time schedule required by the permits.
- 5. Obtain permits as required by authorities having jurisdiction.

# PART 2 PRODUCTS

# 2.01 MATERIALS

- A. Erosion Bales: Hay, straw, or other approved material containing approximately 5 cubic feet of material and weighing not less than 35 pounds. Bales shall be weed free and bound with wire.
- B. Anchor Stakes: 2" x 2" x 3' wood stakes.
- C. Silt Fence: Plastic fiber cloth manufactured especially for erosion control applications consisting of either polyvinylidene chloride nylon/polypropylene, or polypropylene monofilament yarns, with the following requirements:
  - 1. Cloth: Provide insect, rodent, mildew, and rot resistant cloth.

| TEST                                                | MIN REQUIREMENTS    |
|-----------------------------------------------------|---------------------|
| Thickness (ASTM D1910)                              | 15 Mils             |
| Grab Tensile Strength and Wrap (ASTM D1682)         | 100 lbs             |
| Grab Elongation (ASTM D1682)                        | 30%                 |
| Toughness (grab tensile strength x grab elongation) | 5000 lbs. X %       |
| Trapezoid Tear (ASTM D2263)                         | 60 lbs.             |
| Coefficient of Friction (CFMC FFET-5)               | 0.4                 |
| Flow Rate (head change from 30 cm to 10 cm)         | 220 Gal/min/sq. ft. |
| Pore Size (CFMC FFET-1)                             | 0.15 mm (maximum)   |

- 2. Wire Mesh: Standard woven wire field fence, 832-6-11 (32" height), approximately 0.65 lbs./ft or 4" x 4" wire "V" mesh (34" height), approximately 75 lbs./ft.
- 3. Posts: Wood with a minimum length of 5 ft. Furnish wood posts with a minimum diameter of 4 inches.
- 4. Wire Ties: 14 gage minimum.
- 5. Staples for wood posts: No. 9 wire minimum at least 1.5 inches long.
- 6. Sediment Traps: Construct from soil which is reasonably fine textured and well graded to minimize seepage. Do not use organic material.
- F. Vehicle Tracking Gravel: Provide minimum 6" thickness or granular material consisting of 1 1/2" to

3" aggregate over 1/2" to 3/4" thick aggregate filter base.

# PART 3 EXECUTION

# 3.01 CONSTRUCTION REQUIREMENTS

- A. General: General Erosion Control Sheets have been incorporated into the plans. Implement, operate, and maintain in a safe manner all permanent or temporary erosion control features describes in this section and the plan sheets. It is the Contractor's responsibility to conduct the construction work in such a manner to prevent contamination of adjacent waters.
  - 1. Include temporary erosion control in construction work areas outside the project site where necessary for borrow pits, haul roads, and equipment storage sites.
  - 2. Incorporate all permanent erosion control features into the project at the earliest possible time as outlines in the accepted schedule. Maintain erosion control features until project is accepted.
  - 3. Comply with provisions contained within the necessary permits.
- B. Temporary Controls: Provide temporary erosion and sediment control measures for the purpose of correcting conditions that develop during construction not foreseen by the design of the project, or during an emergency situation. Measures proposed by the Contractor must be reviewed by the C.O. and approved prior to installation.
- C. Slopes: Stabilize all cut and fill slopes with landscaping according to the Landscaping Sheets or other seeding and mulching within a period of 14 calendar days where slopes exceed 3:1 (horizontal to vertical).
- D. Silt Fences: Set stakes, excavate 4" x 4" trench upslope of stakes, place filter fabric, backfill and compact trench.
- E. Straw Bales: Excavate 4" depth trench the width of bale. Place bales in trench with tight abutting ends. Stake each bale with two stakes.
- F. Conflicts: In the event of conflicts between these requirements and water quality control laws, rules, or regulations of other Federal, State or local agencies, the more restrictive of the two shall apply.

## 3.02 WATER QUALITY MANAGEMENT REQUIREMENTS

- A. Compliance: Take all reasonable steps to comply with the Erosion Control and Water Quality Plan and the Erosion Control Sheets, and other applicable standards, permit conditions, and regulations of appropriate agencies.
- B. Start of work: Install permanent erosion and sediment control measures at the earliest possible time. As one of the first construction activities, place permanent and temporary erosion and sediment control measures around the perimeter of the project or the initial work area.
- C. Coordination: Coordinate temporary erosion control measures with permanent measures to ensure economical, effective, and continuous control throughout the construction phase.
- D. Disposal: Pollutant byproducts of construction, solids, sludges, pollutants removed in the course of treatment of wastewater, excavation, or excess fill material, and material from sediment traps shall be handles, stockpiles, or disposed of in such a manner so entry into any waterbodies or wetlands

within or outside the project boundaries is prevented.

# 3.03 MAINTENANCE

- A. Continuously maintain all erosion and sediment control measures so that they perform their intended function during the construction of the project.
- B. Remove and replace sediment laden and ineffective bales with new straw bales.
- C. Remove and replace damaged or ineffective silt fences.

END OF SECTION 312319

# SECTION 321217 - PAVEMENT MARKING

# PART 1 GENERAL

#### 1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1-Specification sections, apply to work of this Section.

#### 1.02 SECTION INCLUDES

A. Layout and paint lines, direction arrows and signs on asphalt paving.

# 1.03 RELATED SECTIONS

- A. The following Sections contain requirements that relate to this Section.
  - 1. Section 331313 Asphaltic Concrete Paving.

#### 1.04 SUBMITTALS

- A. Product Data:
  - 1. Submit Technical Data sheets indicating compliance with the tests specified in Table II of Federal Specification TT-P-115 F.
- B. Samples:
  - 1. Submit sample color chip and standard color chip of Federal Specification 595 for white paint.

#### 1.05 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Perform pavement markings by installer regularly engaged in this type of work and with proper equipment for striping a project of this size.
- B. Material Compatibility:
  - 1. Verify compatibility of striping paint with sealers, joint sealants, and all other surface treatments specified in Division 7.
- C. Paint Materials:
  - 1. Paint markings shall not fade, crack, flake, or peel within the warranty period.

# **PAVEMENT MARKING**

## 1.06 DELIVERY, STORAGE AND HANDLING

- A. Store, mix and prepare paints only in areas designated for that purpose.
- B. Furnish clean cans and buckets required for mixing paints and for receiving rags and other waste materials associated with painting. Clean buckets regularly. At the close of each day's work remove used rags and other waste materials associated with painting.
- C. Take precautions to prevent fire in or around painting materials. Furnish and maintain hand fire extinguisher near paint storage and mixing area.

#### 1.07 PROJECT CONDITIONS

A. Do not apply pavement markings in wet weather or when the ambient or receiving material temperature is below 40 degrees F.

# PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Lane Marking Paint: Alkyd-resin type, ready-mixed complying with AASHTO M248, Type I.
  - 1. Color: White. Match Federal Standard 575 for white paint and have the daylight directional reflectance specified in FS TT-P-115F, Type I.
  - 2. Color: Yellow.
  - 3. Color: Red
- B. Drying Time:
  - Furnish paint with a no-pick-up maximum drying time of 20 minutes, when tested according to ASTM D711 using a wet film thickness of 0.015" and when applied and tested at 77 degrees F.

#### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Examine surfaces to which paint will be applied and report immediately in writing to the Architect any conditions detrimental to the proper execution of this work.
- B. Do not proceed until unsatisfactory conditions are acceptably remedied.

#### 3.02 PREPARATION

## **PAVEMENT MARKING**

- A. Verify that surfaced to be painted are in proper condition to receive painting materials, that surfaces are clean, dry, smooth and at proper temperature as recommended by paint manufacturer.
- B. Paint over existing striping and markings where indicated in a paint color matching existing surfacing. Use paint intended for that purpose prior to proceeding with new striping and markings.
- C. Do not paint or finish any surface which is wet or damp.
- D. Clean all surfaces free of adhering foreign matter, dirt and dust.
- E. Lay out all striping per drawings. Report any discrepancies, interferences or changes in striping due to field conditions to Architect prior to painting. Paint Installer shall be required to remove paint, repair surface treatment and repaint stripes not applied in strict accordance with the drawings.

#### 3.03 MIXING

- A. Do not intermix materials of different character or different manufacturer.
- B. Do not thin material except as recommended by manufacturer.

# 3.04 APPLICATION

- A. Apply painting and finishing materials in accordance with the manufacturer's directions. Use applicators and techniques best suited for the material and surfaces to which applied.
- B. Fire Lanes: Paint 6" wide stripes spaced 20' o.c. in red / white / yellow color as indicated. Include the words "Fire Lane" and "No Parking" painted alternately at 25' intervals in white letters 6" high and 1" stroke width.
- C. Handicap Parking: No painted symbols required.
- D. Other Painted Text: Paint white letters for the words "One Way" or "Bus Lane" in accordance with the MUTCD latest revision.
- E. Apply paint with mechanical equipment to produce uniform straight edges. Apply at manufacturer's recommended rates.
- F. Minimum wet film thickness shall be 0.015". Apply in 4" line widths.

#### 3.05 PROTECTION

A. Provide protections to ensure that work will be without damage or deterioration until final acceptance.

END SECTION 321217

# SECTION 331313 - EXTERIOR CONCRETE FLATWORK

# PART 1 GENERAL

## 1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1-Specification sections, apply to work of this Section.

## 1.02 SECTION INCLUDES

- A. Exterior concrete flatwork as shown on the drawings for the following:
  - 1. Curbs
  - 2. Gutters
  - 3. Cross pans
  - 4. Sidewalks
  - 5. Ramps
  - 6. Stairs

# 1.03 RELATED SECTIONS

- A. The following Sections contain requirements that relate to this Section.
  - 1. Section 311001 Earthwork

## 1.04 SUBMITTALS

A. Submit concrete test reports.

# 1.05 QUALITY ASSURANCE

- A. Codes and Standards:
  - 1. For work on public rights-of-way, conform to requirements of authorities having jurisdiction to the extent that they are more stringent than specified herein. Obtain required permits and inspections for work on rights-of-way.

2. Except as otherwise specified or required by authorities having jurisdiction, conform to requirements of ACI 301.

# 1.06 PROJECT/SITE CONDITIONS

- A. Cold Weather Protection:
  - 1. Protect all concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures in compliance with the requirements of ACI 306.
- B. Hot Weather Placing:
  - 1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305.

# PART 2 PRODUCTS

## 2.01 MATERIALS

- A. Forms:
  - 1. Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.
    - a) Use flexible spring steel forms or laminated boards to form radius bends as required.
  - 2. Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.
- B. Portland Cement Concrete:
  - 1. Conform to requirements of Section 033000 including fibrous reinforcing.
- C. Reinforcing Steel:
  - 1. Conform to requirements of Section 033000.
- D. Curing Materials:
  - 1. Conform to requirements of Section 033000.
- E. Concrete Protective Coating:
  - 1. Following requirements of Section 033000.
- F. Expansion Joint Material:
  - 1. 0.5" thick, closed cell polyethylene foam, Texmastic "Vinyltex 3600", Sonneborn "Sonoflex F", or approved equal.

# PART 3 EXECUTION

#### 3.01 EXAMINATION

A. Verify subgrades to ensure adequacy of compaction and suitability to receive exterior concrete flatwork. Start of work under this section constitutes acceptance of subgrade as suitable for exterior concrete flatwork.

#### 3.02 PREPARATION

- A. Staking of Lines and Grades;
  - 1. Provide line and grade stakes for exterior flatwork for alignment and levels.

#### B. Excavation:

1. Excavate to the required depth and to a width that will permit the installation and bracing of the forms. Shape and compact subgrade to a firm even surface. Remove and replace all soft and yielding material with acceptable material.

#### 3.03 FORMING

- A. Forms:
  - 1. Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.
    - a) Check completed formwork for grade and alignment to following tolerances:
      - i) Top of forms not more than 0.125" in 10'.
      - ii) Vertical face on longitudinal axis, not more than 0.25" in 10'.
  - 2. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

# 3.04 REINFORCEMENT

A. Locate, place and support reinforcement as specified in Division -3 sections, unless otherwise indicated.

# 3.05 MIXING AND PLACING CONCRETE

- A. Follow requirements of Section 033000.
- B. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition a time concrete is placed. Do not

place concrete around manholes or other structures until they are at required finish elevation and alignment.

- C. Curbs and Gutters:
  - Automatic machine may be used for curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed minimum specified. Machine placement must produce curbs and gutters to required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

## 3.06 FINISHING

- A. After strlking-off and consolidating concrete, smooth surface by screening and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.
- B. After floating, test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.
- C. Finish surfaces with a wooden or magnesium float. Plastering of surfaces is not permitted.
- D. Immediately after float finishing, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Use fine hair fiber-bristle broom unless otherwise directed. Coordinate the required final finish with the Architect before application. 1. On inclined slab surfaces, provide a coarse, non-slip finish by scoring surface with a stiff-bristled broom, perpendicular to line of traffic.
- E. Edge all outside edges of the slab and all joints with a 0.25" radius edging tool.
- F. Work edges of gutters, back top edge of curb, and formed joints with an edging tool, and round to 0.5" radius, unless otherwise indicated. Eliminate tool marks on concrete surface.
- G. Form Removal:
  - 1. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Architect.

## 3.07 JOINTS

- A. Curb and Gutter Expansion Joints:
  - 1. Form expansion joints at intervals shown on the plans using a preformed expansion joint filler having a thickness of 0.5". When the curb is constructed adjacent to or on concrete pavement, locate expansion joints opposite or at expansion joints in the pavement.
  - 2. Install expansion joints between concrete curb and any fixed structure or sidewalk. Extend expansion joint material for full depth of contact surface. Where joint sealer is indicated, stop expansion joint material not less than 0.5" and no more than 1" below finished surface. Protect top edge with metal cap.
- B. Sidewalk Joints:

- Divide the sidewalk into sections by dummy joints formed by a jointing tool or other acceptable means as directed. Extend these dummy joints into the concrete for at least 1/3 of the depth and make approximately 0.125" wide. Provide expansion joints where indicated.
- 2. Provide construction joints around all appurtenances such as manholes, utility poles, and other penetrations, extending into and through sidewalks. Install 0.5" thick preformed expansion in these joints. Install expansion joint filler between concrete sidewalks and any fixed structure such as a building. Extend expansion joint material for full depth of concrete except stop 0.5" below finish surface. Protect top edge of joint filler with removable material or metal cap.

# 3.08 CURING

- A. Immediately upon completion of the finishing, moisten concrete and keep moist for three days, or cure concrete by use of membrane forming curing compounds as specified in Section 033000.
- B. During the curing period exclude all traffic, both pedestrian and vehicular.
- C. For surfaces to receive protective coating, cure by use of absorptive cover.
- D. Apply protective concrete coating specified in Section 033000 to exterior pedestrian paving, ramps, sidewalks and terrace surfaces which are subject to de-icing salts. Apply after concrete is cured and surfaces are clean and dry. Apply proprietary materials in accordance with manufacturer's recommendations. Protect surfaces from vehicular or pedestrian traffic until dry.

# 3.09 CLEANING

A. Sweep concrete and wash free of stains, discolorations, dirt or other foreign material prior to final inspection.

END SECTION 331313

# SECTION 334100 - STORM & SANITARY

#### PART 1 GENERAL

#### 1.01 SUMMARY

- A. This Section includes sewerage and drainage systems outside the building. Systems include the following:
  - 1. Sanitary sewerage.
  - 2. Storm drainage.
  - 3. Detention and Water Quality Ponds.
- B. Related Sections:
  - 1. Division 2 Section "Excavation, Trenching and Backfill" for bedding requirements.
  - 2. Division 2 Section "Foundation Drainage Systems".
  - 3. Division 15 Section "Plumbing" for sanitary and storm drain systems inside building.

## 1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. City and County of Denver Wastewater Management Division Standards for Sanitary Sewer and Storm Drainage Construction. The Contractor shall obtain and maintain on site copies of both the following documents, as they provide details for materials and construction to be used on this project. The documents can be obtained from the City and County of Denver, Wastewater Management Division, 2300 West Third Avenue, Denver, Colorado 80223, or the City and County of Denver web site. If there are any conflicts between these specifications and the following documents, the documents shall govern.
  - 1. Storm Drainage and Sanitary Sewer Construction Detail and Specifications, latest edition.
  - 2. Standard Details, 1995.
- C. Colorado Department of Transportation (CDOT) Standard Specifications for road and Bridge Construction. The Contractor shall obtain and maintain on site a copy of this document, as it provides details for materials and construction to be used on this project. The document can be obtained from the Colorado Department of Transportation, Office of Bid Plans, 4201 East Arkansas Avenue, Denver, Colorado 80222. If there are any conflicts between these specifications and referenced portions of the CDOT Specifications, the referenced CDOT specifications shall govern.

# 1.03 DEFINITIONS

A. Drainage Piping: System of sewer pipe, fittings, and appurtenances for gravity flow of storm drainage.

- B. Sewerage Piping: System of sewer pipe, fittings, and appurtenances for gravity flow of sanitary sewage.
- C. Detention Pond: System of sewer pipe, fittings, and depressed grading area for detention of drainage waters.
- D. Water Quality Pond: System of sewer pipe, fitting and depressed areas for detention of drainage waters and treatment for water quality.

## 1.04 SUBMITTALS

- A. General. Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections. Submittals shall be provided in a timely manner to allow a minimum of one week for review, and so the review shall not affect the timely advance of the project.
- B. Shop drawings for precast concrete manholes and other structures. Include frames, inlet structures, covers, and grates, etc.
- C. Shop drawings for cast-in-place concrete and other structures. Include frames, inlet structures, covers, and grates.
- D. Details of all fittings and specials shall be submitted for approval to the Project Manager prior to construction. Fittings and specials shall be made up materials having he same structural qualities as the adjoining pipe, and shall have the interior treated the same as the pipe.
- E. The Contractor shall submit Shop Drawings showing the exact dimensions of the joints, including permissible tolerances, for each size of concrete pipe being furnished and the size, type and locations of gasket materials.
- F. Inspection and test reports specified in the "Quality Control" Section.
- G. At project Closeout, the Contractor shall submit as-built drawings prepared in accordance with City and County of Denver requirements. The Contractor shall include an as-built survey, prepared and certified by a registered Professional Land Surveyor, of all detention and water quality ponds so that the design volumes can be certified by the Engineer.

## 1.05 QUALITY ASSURANCE

- A. Environmental Agency Compliance: Comply with regulations pertaining to construction of sanitary sewerage and storm drainage systems. This includes, erosion and storm water control, management of concrete and other waste materials, spill management, etc.
- B. Utility Compliance: Comply with City and County of Denver Wastewater Management Division regulations pertaining to the construction of sanitary sewerage and storm drainage systems.

# 1.06 DELIVERY, STORAGE, AND HANDLING

- A. General. Sections 10.1.8 and 10.1.9 of the City and County of Denver Wastewater Management Division Standards for Sanitary Sewer and Storm Drainage Construction.
  - 1. Protect pipe, pipe fittings, and seals from dirt and damage.

- 2. Handle precast concrete pipe, manholes and other structures according to manufacturer's rigging instructions.
- B. Reinforced Concrete Pipe. Sections 10.1.8 and 10.1.9 of the City and County of Denver Wastewater Management Division Standards for Sanitary Sewer and Storm Drainage Construction.
- C. Poly Vinyl chloride Pipe. Sections 10.6.5, and subsections, of the City and County of Denver Wastewater Management Division Standards for Sanitary Sewer and Storm Drainage Construction.
- D. Manholes and Inlets. The requirements for handling, storage and acceptance of precast structures shall be the same as for precast reinforced concrete pipe.

# 1.07 PROJECT CONDITIONS

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.
- B. At all locations where the new Sewerage and Drainage Facilities connect to existing features, the Subcontractor shall pothole and expose piping to verify alignment and grades of the existing facilities. Prior to proceeding with installation of new work, the subcontractor shall report any problems to the Engineer in the event grades and alignment deviate from that shown on the drawings.
- C. Existing Utilities. Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.
  - 1. Notify Project Designer not less than 48 hours in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without receiving Project Designer's written permission.

# 1.08 SEQUENCING AND SCHEDULING

- A. Coordinate sanitary sewerage system connection with the City and County of Denver Wastewater Management Division.
- B. Coordinate storm drainage system connections with the City and County of Denver Wastewater Management Division.

## PART 2 PRODUCTS

# 2.01 GENERAL

A. All materials provided as part of this specification or as shown on the Drawings shall be as specified in the in the City and County of Denver Wastewater Management Division Standards for Sanitary Sewer and Storm Drainage Construction. If any discrepancies exist between what is specified herein or on the Drawings and what is specified in the City and County of Denver Wastewater Management Division Standards for Sanitary Sewer and Storm Drainage Construction, the Contractor shall immediately notify the Engineer. The materials specified in the City and County of Denver Wastewater Management Division Standards for Sanitary Sewer and Storm Drainage Construction have precedence over materials specified herein.

# 2.02 PIPES AND FITTINGS

- A. Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
  - 1. All materials, manufacturing, operations, testing and production shall comply with the requirements of Section 10.6.2 of the *Storm Drainage and Sanitary Sewer Construction Detail and Specifications, latest edition.*
  - 2. All PVC sewer materials shall comply with the requirements of Section 10.6.3 of the *Storm Drainage and Sanitary Sewer Construction Detail and Specifications, latest edition.* 
    - a) Pipe and Fittings Section 10.6.3.1
    - b) Gaskets Section 10.6.3.2
    - c) Lubricant Section 10.6.3.3
- B. Reinforced-Concrete Sewer Pipe and Fittings:
  - 1. All materials, manufacturing, operations, testing and production shall comply with the requirements of Sections 10.1.2, 10.1.7 and 10.1.9 of the *Storm Drainage and Sanitary Sewer Construction Detail and Specifications, latest edition.*
  - 2. Diameter of the Pipe the diameter indicated on the Contract Documents shall mean the inside diameter of the pipe.
  - 3. Wall Thickness and Class of Pipe Section 10.1.4
  - 4. Lifting Holes Section 10.1.6
  - 5. Joints Section 10.1.10, including subsections, and Standard Drawings S-401 through S-450.
  - 6. Protective Coatings Section 10.1.11

# 2.03 MANHOLES

- A. Except where otherwise specified or indicated on the drawings, storm and sanitary sewer manholes shall conform to the requirements as set forth in Section 11 of Storm Drainage and Sanitary Sewer Construction Detail and Specifications, latest edition, and the Standard Drawings. If necessary, all manholes and related component items shall be designed for AASHTO HS20 loading.
- B. Manholes may be precast or cast-in-place as required by the Drawings. If not detailed in the Drawings, the Contractor may use either, upon approval by the Engineer.

- C. Size Section 11.0.2.1
- D. Materials
  - 1. Section 11.0.2.2 and subsections describe concrete, reinforcing steel, frames and covers, manhole steps, flexible joint sealing compound, adjustment brick, and mortar and grout.
  - 2. Standard Drawings S-401, S-450 and S-501.1 through S-550 also provide information for the making and construction of manholes.
  - 3. Standard Drawing No. S-450 describes riser rings.
  - 4. Standard Drawing No. S-701 describes cast-iron rings and covers.
  - 5. Standard Drawing No. S-750 describes standard steps.
- E. Bases and Inverts Section 11.0.2.3 and the Standard Drawings.
- F. Stub-outs Section 11.0.2.4 and the Standard Drawings.
- G. Flexible Booted Connections Section 11.0.2.5 and the Standard Drawings.

# 2.04 CATCH BASINS/STORM WATER INLETS

- A. Except where otherwise specified or indicated on the drawings, inlets shall conform to the requirements as set forth in Section 11 of *Storm Drainage and Sanitary Sewer Construction Detail and Specifications, latest edition, and the Standard Drawings.* If necessary, all manholes and related component items shall be designed for AASHTO HS20 loading.
- B. Inlets may be precast or cast-in-place as required by the Drawings. If not detailed in the Drawings, the Contractor may use either, upon approval by the Engineer.
- C. Materials Section 11.0.3.1, including subsections, and Standard Drawings S-616.1 through S-620.2
- D. Materials
  - 1. Section 11.0.3.1, including subsections, describe concrete, masonry mortar, reinforcing steel, connectors, castings, and steps.
  - 2, Standard Drawings S-616.1 through S-620.2 also provide information for the making and construction of inlets.
  - 3. Standard Drawing No. S-450 describes riser rings.
  - 4. Standard Drawing No. S-701 describes cast-iron rings and covers (used with Type 14 inlets)
  - 5. Standard Drawing No. S-750 describes standard steps.

# 2.05 CONCRETE - ONSITE DRAINAGE RELATED

A. General: Cast-in-place concrete shall conform to the requirements of Section 11.0.1 of the *Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.* 

## 2.06 CLEANOUTS

- A. Description: ASME A112.36.2M, round, cast-iron housing with clamping device and round, secured, scoriated, cast-iron cover. Include cast-iron ferrule with inside caulk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:
  - 1. Light Duty: In earth or grass, foot-traffic areas.
  - 2. Medium Duty: In paved, foot-traffic areas.
  - 3. Heavy Duty: In vehicle-traffic service areas.
  - 4. Extra Heavy Duty: In roads.
- B. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, service class, cast-iron soil pipe and fittings or same material as sewer main.

### 2.07 OUTFALLS

- A. Construct headwalls, of cast-in-place, reinforced concrete per CDOT Standard details.
- B. Riprap: In accordance with Urban Drainage & Flood Control District Storm Drainage Criteria Manual.

#### PART 3 EXECUTION

## 3.01 GENERAL

- A. Contractor shall notify the City of Denver Inspector at least 24 hours prior to covering any work. Work shall not be covered without allowing at least 24 hours for an inspection.
- B. All work installed as part of this specification shall be completed in accordance with the requirements specified in the City and County of Denver Wastewater Management Division Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications and Standard Details (dated 1995), and documents referenced therein. If any discrepancies exist between what is specified herein and what is specified in the City and County of Denver Specifications and Standard Details, the Contractor shall immediately notify the Engineer. The requirements specified in the City and County of Denver Wastewater Management Division Specifications and Standard Details have precedence over requirements specified herein.

## 3.02 EARTHWORK

A. For Piping

- 1. The requirements for excavating, trenching, and backfilling pipe are specified in Division 2 Section 02221 - Excavation, Trenching and Backfilling.
- The requirements for pipe bedding, and the geofabric to be placed between the bedding and backfill materials, are specified in Division 2 Section 02221 – Excavation Trenching and Backfilling.
- 3. The requirements for final grading and landscaping are specified in Division 2 Section.
- B. For Structures
  - 1. General. All excavation for the construction of structures shall be in conformance with the applicable provisions of the CDOT Specifications, Section 206, except as modified herein.
  - Unless otherwise stipulated in the Proposal or in the Measurement and Payment portions of these specifications, no separate payment will me made for structural excavation, except for overexcavation as directed by the Engineer, and all costs incurred will be considered to be included in the unit price bid for the associated structure.
  - 3. Overexcavation.
    - a) In locations where soil with unsuitable bearing characteristics are encountered, the Engineer may order that the unsuitable material be removed and be replaced with granular and/or rock backfill material to provide suitable bearing for the structure.
    - b) The overexcavation will paid for in accordance with the unit price set forth in the proposal for excavation and replacement with granular material; provided, however, no measurement for payment will be made of any material required to fill over excavated areas outside of the pay limits specified in the CDOT Specifications Section 206.3, if the Contractor for his own convenience, excavates beyond the limits required for structural excavation, the excavation and backfill thereof shall be at the Contractor's expense; or where excavations for footings, slabs, etc., are made below the required elevations without specific authorization from the Engineer, the over excavated area shall be filled in a manner satisfactory to the Engineer by the Contractor at his expense.
  - 4. Removal of Water. All water encountered in structural excavations shall be removed as required in Section 02221 of these Specifications.
  - 5. Backfill.
    - a) General.
      - Backfill around structures shall be as per requirements of CDOT Section 206.3, and backfill shall be placed only after walls or other constructed items have been inspected and the approval of the Engineer to commence backfilling has been obtained.
      - Backfilling against structures is allowed only after the concrete has properly cured for not less than seven days, or until other testing procedures (i.e., concrete test cylinders) indicate the concrete has attained sufficient strength so as not to be damaged by the backfilling operation.
    - b) Section 11.04, and subsections, of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications includes information specific to the backfill requirements around manholes structures, inlets, utilities and appurtenances.

# 3.03 EXISTING FACILITIES

- A. General.
  - The Contractor shall at all times take extreme and proper precautions for the protection of utility lines, the presence of which are known or can be determined by the examination of appropriate utility maps, exploratory excavations, etc. The Contractor shall be responsible for the repair of any damaged service or utility lines, and any utility line damaged by construction operations shall be repaired at the Contractor's expense.
  - 2. The Contractor shall notify the Denver Water Board, Xcel Energy, telephone, cable and fiber optic companies, as well as all other interested parties, prior to commencement of work in order to ensure there will not be interruptions of these services during construction. Existing utility lines and utility poles, trees, shrubbery, fences, water mains, gas mains, sewers, cables, conduits, curb, gutter, walks, and other structures in the vicinity of the work not authorized to be removed, shall be supported and protected from damage by the Contractor until all construction and related work is complete. The Contractor shall be liable for all damage done to existing facilities, structures, and property.
  - 3. Section 3 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications, including subsections, describe procedures to be used for managing existing facilities.
- B. Utilities. Utilities, underground and above-ground, shall include but not be limited to: fiber optics (including empty ducts), gas, telephone, electric, steam, water, sanitary and storm sewers, telegraph lines, conduits, all abandoned utilities, etc., and their accessories, appurtenances and service connection. The type, size, location and number of all known above-ground and underground utilities have been shown on the drawings, however, no guarantee is made as to the true size, location or number of such utilities. It shall be the responsibility of the Contractor to verify the existence and location (vertically and horizontally) of all underground utilities along the route of the work, to ensure construction as shown in the Contract Documents. The omission from of the inclusion of existing or abandoned utility locations on the drawings is not to be considered as the nonexistence of, or a definite location of, said utilities.
- C. Exploratory Excavations. See Section 3.0.3 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.
- D. Relocation and Adjustment of Utilities. See Section 3.0.4 and subsections of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.
- E. Abandonment of Existing Sewer Facilities. See Section 3.0.5 and subsections of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.
- F. Crossing of Existing Utilities. See Section 3.0.6 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

# 3.04 INSTALLATION/CONSTRUCTION OF SEWER PIPING

- A. General. General requirements for the installation of sewer piping can be found on Standard Detail Drawings S-301.1 through S-350, and S-401 through S-450, and in Section 4 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.
  - 1. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of underground sewerage and drainage systems piping. Location and arrangement of piping layout take into account many design considerations. Install piping as indicated.
  - 2. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals,

sleeves, and couplings according to manufacturer's recommendations for use of lubricants, cements, and other installation requirements.

- 3. Use manholes for changes in direction, except where fittings are indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.
- 4. Use proper size increasers, reducers, and couplings, where different sizes or materials of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.
- 5. Install gravity-flow-systems piping at constant slope between points and elevations indicated. Install straight piping runs at constant slope, not less than that specified, where slope is not indicated.
- 6. Extend sewerage piping and connect to building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.
- 7. Install sewerage piping pitched down in direction of flow, at minimum slope of 2% except where otherwise indicated.
- 8. Extend drainage piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.
- B. Reinforced Concrete Pipe (RCP).
  - 1. General. Requirements specific to the installation of RCP are provided in Section 10.1 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.
  - 2. Joints. See Section 10.1.10 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.
  - 3. Protective Coatings. See Section 10.1.11 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.
- C. Poly Vinyl chloride Pipe (PVC).
  - 1. General. Requirements specific to the installation of RCP are provided in Section 10.6, especially 10.6.6 and subsections, of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.
  - 2. Joints. See Section 10.6.6.3 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.
  - 3. Cutting and Beveling Pipe. See Section 10.6.6.4 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.
  - 4. Sanitary Sewer Connections. See Section 10.6.6.5 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.
  - 5. Water Stops. See Section 10.6.6.6 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.
  - 6. Field Performance and Acceptance Tests. See Section 10.6.7, and subsections, of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

## DTO - COMMAND VEHICLE STORAGE

# 3.05 MANHOLE AND CATCH BASIN INSTALLATION

A. General. Except where otherwise indicated in these and referenced specifications, manholes, special structures, box culverts, vaults, storm inlets, and other miscellaneous structures and appurtenances shall conform to the details included in these and referenced specifications.

# B. Manholes.

- General. Requirements specific to the installation of manholes are provided in Section 11.0.2, and subsections, of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications, and in Standard Details S-450, S501.1 through S-550, and S-701 through S-750. The Contractor should pay especial attention to Notes on and at the bottom of the Standard Details.
- 2. Bases and Inverts. See Section 11.0.2.3, and subsections, of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications, and Standard Details S501.1 through S-520.
- 3. Stubouts. See Section 11.0.2.4 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.
- 4. Flexible Booted Connections. See Section 11.0.2.5 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.
- C. Inlets.
  - General. Requirements specific to the installation of inlets are provided in Section 11.0.3, and subsections, of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications, and in Standard Details S-616.1 through S-620.2, and S-701 through S-750. The Contractor should pay especial attention to Notes on and at the bottom of the Standard Details.
  - 2. Inlet Depths. See Section 11.0.3.2.2 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications, and Standard Details S501.1 through S-520.
  - 3. Forming. See Section 11.0.3.2.3 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

## 3.06 STORM DRAINAGE INLET AND OUTFALL INSTALLATION

- A. Construct inlet headwalls of reinforced concrete, as indicated.
- B. Construct outlet headwalls of reinforced concrete, as indicated.
- C. Construct riprap as indicated.
- D. Install outlets with flared ends sections that match pipe, where indicated.

# 3.07 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318, ACI 350R, and as indicated in Division 3.

## STORM AND SANITARY

B. Concrete pavement shall be as directed in Section 02751 and Section 03300 Concrete.

#### 3.08 DRAINAGE SYSTEM INSTALLATION

- A. Assemble and install components according to manufacturer's written instructions and as indicated.
- B. Assemble and install components according to manufacturer's written instructions, ASME A112.3.1, and as indicated.
- C. Install with top surfaces of components, except piping, flush with final finished surface, except as required for cast-iron ring and covers.
- D. Warning Tape shall be placed above the following buried utilities: (Omitted)
  - 1. Storm Sewer place tape at 1' below rough grade.
  - 2. Sanitary Sewer place tape at 1' below rough grade.
- E. Signal Wire shall be buried with non-metallic pipes.

## 3.09 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
- B. Set cleanout frames and covers in concrete paving with tops flush with surface of paving.

## 3.10 FIELD QUALITY CONTROL

- A. In accordance with the requirements of Section 01400. If a discrepancy exists between this section and 01400, section 01400 will supercede.
- B. Clear interior of piping and structures of dirt and superfluous material as the work progresses.
  - 1. Place plug in end of incomplete piping at end of day and whenever work stops.
  - 2. Flush piping between manholes and other structures, if required by authorities having jurisdiction, to remove collected debris.
- C. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 in. of backfill is in place, and again at completion of the Project.
  - 1. Submit separate reports for each system inspection.
  - 2. Defects requiring correction include the following:
    - a) Alignment: Less than full diameter of inside of pipe is visual between structures.

- b) Deflection: Flexible piping with deflection that prevents passage of a ball or cylinder of a size not less than 92.5% of piping diameter.
- c) Crushed, broken, cracked, or otherwise damaged piping.
- d) Infiltration: Water leakage into piping.
- e) Exfiltration: Water leakage from or around piping.
- 3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
- 4. Re-inspect and repeat procedure until results are satisfactory.
- D. Test new piping systems and parts of existing systems that have been altered, extended, or repaired for leaks and defects as required by Section 9 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.
  - 1. Schedule tests, and their inspections by authorities having jurisdiction, with at least 24 hours; advance notice.
  - 2. Submit separate reports for each test.

END OF SECTION 02700

# CITY AND COUNTY OF DENVER

## STATE OF COLORADO



## DEPARTMENT OF PUBLIC WORKS / ENGINEERING DIVISION

# **Drawings**

# **Contract No. 201206436**

## DENVER POLICE DEPARTMENT COMMAND VEHICLE GARAGE

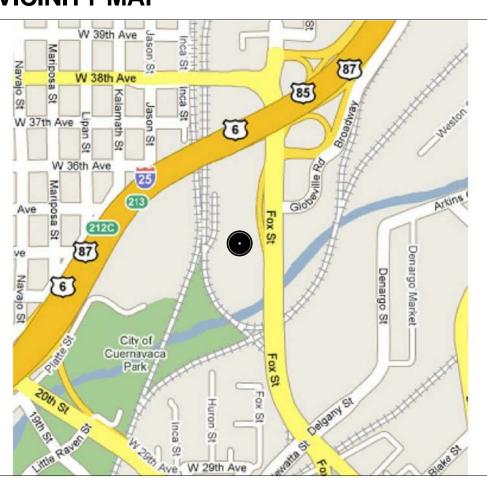
June 6, 2012

| A/C<br>AB<br>ACOUST<br>ACT<br>ADDL                                                                                                                                                                                                                                  | AIR CONDITIONING                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | GAL                                                                                                                                                                                                      | G                                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| ACT                                                                                                                                                                                                                                                                 | ANCHOR BOLT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | GALV                                                                                                                                                                                                     | G                                                                               |
|                                                                                                                                                                                                                                                                     | ACOUSTICAL<br>ACOUSTICAL CEILING TILE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | GA<br>GC                                                                                                                                                                                                 | G<br>G                                                                          |
|                                                                                                                                                                                                                                                                     | ADDITIONAL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | GEN                                                                                                                                                                                                      | G                                                                               |
| \DJ<br>\FF                                                                                                                                                                                                                                                          | ADJACENT / ADJUSTABLE<br>ABOVE FINISH FLOOR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | G.I.<br>GL                                                                                                                                                                                               | G<br>G                                                                          |
| ALT<br>ALUM                                                                                                                                                                                                                                                         | ALTERNATE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | GR<br>GYP                                                                                                                                                                                                | G<br>G                                                                          |
| NOD                                                                                                                                                                                                                                                                 | ANODIZED                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                          |                                                                                 |
| APPROX<br>ARCH                                                                                                                                                                                                                                                      | APPROXIMATE<br>ARCHITECT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | H<br>HB                                                                                                                                                                                                  | H<br>H                                                                          |
| ASSY<br>AUTO                                                                                                                                                                                                                                                        | ASSEMBLY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | HC<br>HDBD                                                                                                                                                                                               | <u>н</u><br>н                                                                   |
| <b>NUX</b>                                                                                                                                                                                                                                                          | AUXILIARY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | HDR                                                                                                                                                                                                      | Н                                                                               |
| √V<br>∖VG                                                                                                                                                                                                                                                           | AUDIO - VISUAL<br>AVERAGE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | HDWR<br>HDWD                                                                                                                                                                                             | H.<br>H.                                                                        |
| 3D                                                                                                                                                                                                                                                                  | BOARD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | HGT<br>HM                                                                                                                                                                                                | H<br>H                                                                          |
| BITUM                                                                                                                                                                                                                                                               | BITUMINOUS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | HORIZ                                                                                                                                                                                                    | Н                                                                               |
| BLDG<br>BLKG                                                                                                                                                                                                                                                        | BUILDING<br>BLOCKING                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | HP<br>HR                                                                                                                                                                                                 | H<br>H                                                                          |
| BM<br>B.O.                                                                                                                                                                                                                                                          | BEAM<br>BOTTOM OF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | HVAC                                                                                                                                                                                                     | H<br>Al                                                                         |
| 8.0.<br>80T                                                                                                                                                                                                                                                         | BOTTOM OF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | HW                                                                                                                                                                                                       | H                                                                               |
| 3.O.W.<br>3RG                                                                                                                                                                                                                                                       | BOTTOM OF WALL<br>BEARING                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | IBC                                                                                                                                                                                                      | <br>IN                                                                          |
| SMT                                                                                                                                                                                                                                                                 | BASEMENT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ID                                                                                                                                                                                                       | IN<br>IN                                                                        |
| BTWN<br>B.U.R.                                                                                                                                                                                                                                                      | BETWEEN<br>BUILT-UP ROOF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | IN<br>INCAND                                                                                                                                                                                             | IN                                                                              |
| CAB                                                                                                                                                                                                                                                                 | CABINET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | INCL<br>INFO                                                                                                                                                                                             | IN<br>IN                                                                        |
| В                                                                                                                                                                                                                                                                   | CHALKBOARD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | INSUL                                                                                                                                                                                                    | IN                                                                              |
| ER<br>FCI                                                                                                                                                                                                                                                           | CERAMIC<br>CONTRACTOR FURNISHED /                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | INT<br>INV                                                                                                                                                                                               | IN<br>IN                                                                        |
| FOI                                                                                                                                                                                                                                                                 | CONTRACTOR INSTALLED<br>CONTRACTOR FURNISHED /                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | IRRIG                                                                                                                                                                                                    | IR                                                                              |
|                                                                                                                                                                                                                                                                     | OWNER INSTALLED                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | JAN                                                                                                                                                                                                      | JÆ                                                                              |
| XI<br>XIP                                                                                                                                                                                                                                                           | CAST IRON<br>CAST IN PLACE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | JT                                                                                                                                                                                                       | JC                                                                              |
| ,J                                                                                                                                                                                                                                                                  | CONTROL JOINT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | KIT.                                                                                                                                                                                                     | KI                                                                              |
| )L<br>)LG                                                                                                                                                                                                                                                           | CENTER LINE<br>CEILING                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | L                                                                                                                                                                                                        | LC                                                                              |
| CLR<br>CMU                                                                                                                                                                                                                                                          | CLEAR<br>CONCRETE MASONRY UNIT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | LAB<br>LAM                                                                                                                                                                                               | L/<br>L/                                                                        |
| COL                                                                                                                                                                                                                                                                 | COLUMN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | LAV                                                                                                                                                                                                      | L/                                                                              |
| CONC<br>CONN                                                                                                                                                                                                                                                        | CONCRETE<br>CONNECTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | LB<br>LDR                                                                                                                                                                                                | P(<br>LE                                                                        |
| CONST<br>CONT                                                                                                                                                                                                                                                       | CONSTRUCTION (CONSTRUCT)<br>CONTINUOUS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | LF<br>LH                                                                                                                                                                                                 | LI                                                                              |
| CONTR                                                                                                                                                                                                                                                               | CONTRACTOR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | LHR                                                                                                                                                                                                      | LE                                                                              |
| COORD<br>CPT                                                                                                                                                                                                                                                        | COORDINATE<br>CARPET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | LLH<br>LLV                                                                                                                                                                                               | L(<br>L(                                                                        |
| СТ                                                                                                                                                                                                                                                                  | CERAMIC TILE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | LP                                                                                                                                                                                                       | LC                                                                              |
| CTR<br>CTSK                                                                                                                                                                                                                                                         | CENTER<br>COUNTERSINK (COUNTERSUNK)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | LTWT<br>LVL                                                                                                                                                                                              | LI                                                                              |
| CU<br>CUH                                                                                                                                                                                                                                                           | CUBIC<br>CABINET UNIT HEATER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | MAINT                                                                                                                                                                                                    | M                                                                               |
| CW                                                                                                                                                                                                                                                                  | COLD WATER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | MAS                                                                                                                                                                                                      | М                                                                               |
| C.Y.                                                                                                                                                                                                                                                                | CUBIC YARD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | MATL<br>MAX                                                                                                                                                                                              | M<br>M                                                                          |
| )<br>)BL                                                                                                                                                                                                                                                            | DEEP<br>DOUBLE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | MECH<br>MED                                                                                                                                                                                              | <u>М</u><br>М                                                                   |
| DEMO                                                                                                                                                                                                                                                                | DEMOLITION / DEMOLISH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | MEM                                                                                                                                                                                                      | М                                                                               |
| )EPT<br>)TL                                                                                                                                                                                                                                                         | DEPARTMENT<br>DETAIL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | MEZZ<br>MFR                                                                                                                                                                                              | MM                                                                              |
| DF<br>DIA                                                                                                                                                                                                                                                           | DRINKING FOUNTAIN<br>DIAMETER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | MIN<br>MISC                                                                                                                                                                                              | М<br>М                                                                          |
| DIAG                                                                                                                                                                                                                                                                | DIAGONAL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | MLD                                                                                                                                                                                                      | М                                                                               |
| DIM.<br>DISP                                                                                                                                                                                                                                                        | DIMENSION<br>DISPENSER / DISPOSAL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | MLWK<br>MO                                                                                                                                                                                               | M<br>M                                                                          |
| )N<br>)R                                                                                                                                                                                                                                                            | DOWN<br>DOOR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | MTD<br>MTL                                                                                                                                                                                               | M<br>M                                                                          |
| )S                                                                                                                                                                                                                                                                  | DOWN SPOUT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | MTG                                                                                                                                                                                                      | М                                                                               |
| ow<br>owg                                                                                                                                                                                                                                                           | DISHWASHER<br>DRAWING                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | MULL<br>MULT                                                                                                                                                                                             | M<br>M                                                                          |
| Ē                                                                                                                                                                                                                                                                   | EAST                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | N                                                                                                                                                                                                        | N                                                                               |
| E) / EXG                                                                                                                                                                                                                                                            | EXISTING                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | N/A                                                                                                                                                                                                      | N                                                                               |
| EA<br>EF                                                                                                                                                                                                                                                            | EACH<br>EXHAUST FAN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | NEG<br>NFPA                                                                                                                                                                                              | N<br>N                                                                          |
| IFS<br>J                                                                                                                                                                                                                                                            | EXTERIOR INSULAT. FINISH SYSTEM<br>EXPANSION JOINT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | N.I.C.<br>NO                                                                                                                                                                                             | <u>N</u>                                                                        |
| L                                                                                                                                                                                                                                                                   | ELEVATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | NOM                                                                                                                                                                                                      | N                                                                               |
| ELEC<br>ELEV                                                                                                                                                                                                                                                        | ELECTRICAL<br>ELEVATOR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | NRC<br>NTS                                                                                                                                                                                               | N<br>N                                                                          |
| MER<br>NAM                                                                                                                                                                                                                                                          | EMERGENCY<br>ENAMEL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | OC                                                                                                                                                                                                       | 0                                                                               |
| NCL                                                                                                                                                                                                                                                                 | ENCLOSURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | OD                                                                                                                                                                                                       | 0                                                                               |
| NGR<br>Q                                                                                                                                                                                                                                                            | ENGINEER<br>EQUAL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | OFCI                                                                                                                                                                                                     | O<br>C                                                                          |
| QUIP                                                                                                                                                                                                                                                                | EQUIPMENT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | OFOI                                                                                                                                                                                                     | 0                                                                               |
| ESMT<br>EST                                                                                                                                                                                                                                                         | EASEMENT<br>ESTIMATE (D)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ОН                                                                                                                                                                                                       | 0<br>0                                                                          |
|                                                                                                                                                                                                                                                                     | EACH WAY<br>ELECTRIC WATER COOLER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | OPH<br>OPNG                                                                                                                                                                                              | 0<br>0                                                                          |
|                                                                                                                                                                                                                                                                     | EXHAUST<br>EXPANSION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | OPP                                                                                                                                                                                                      | 0                                                                               |
| EWC<br>EXH                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ORD                                                                                                                                                                                                      | 0                                                                               |
| EWC<br>EXH<br>EXP                                                                                                                                                                                                                                                   | EXTERIOR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ORIG                                                                                                                                                                                                     | 0                                                                               |
| EWC<br>EXH<br>EXP<br>EXT                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | PA                                                                                                                                                                                                       |                                                                                 |
| EWC<br>EXH<br>EXP<br>EXT<br>F.A.<br>FAB                                                                                                                                                                                                                             | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | PA<br>PART BD                                                                                                                                                                                            | PI<br>P/                                                                        |
| EWC<br>EXH<br>EXP<br>EXT<br>F.A.<br>FAB<br>FBO<br>F.C.                                                                                                                                                                                                              | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | PA                                                                                                                                                                                                       | PI<br>P/<br>PI<br>PI                                                            |
| EWC<br>EXH<br>EXP<br>EXT<br>E.A.<br>EAB<br>EBO<br>E.C.<br>E.D.                                                                                                                                                                                                      | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | PA<br>PART BD<br>PC<br>PERIM<br>PERP                                                                                                                                                                     | PI<br>P<br>PI<br>PI                                                             |
| EWC<br>EXH<br>EXP<br>EXT<br>F.A.<br>FAB<br>FBO<br>F.C.<br>F.D.<br>FDTN<br>FE                                                                                                                                                                                        | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB<br>FLOOR DRAIN<br>FOUNDATION<br>FIRE EXTINGUISHER                                                                                                                                                                                                                                                                                                                                                                                                                           | PA<br>PART BD<br>PC<br>PERIM<br>PERP<br>P.L.<br>PL                                                                                                                                                       | PI<br>P/<br>PI<br>PI<br>PI<br>PI<br>PI                                          |
| EWC<br>EXH<br>EXP<br>EXT<br>EA.<br>EAB<br>EBO<br>E.C.<br>ED.<br>EDTN<br>EE<br>E.E.C.                                                                                                                                                                                | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB<br>FLOOR DRAIN<br>FOUNDATION                                                                                                                                                                                                                                                                                                                                                                                                                                                | PA<br>PART BD<br>PC<br>PERIM<br>PERP<br>P.L.                                                                                                                                                             | PI<br>Pi<br>PI<br>PI<br>PI<br>PI<br>PI                                          |
| EWC<br>EXH<br>EXP<br>EXT<br>EXT<br>E.A.<br>F.A.<br>F.BO<br>F.C.<br>F.D.<br>F.D.<br>F.D.<br>F.E.C.<br>F.<br>F.H.                                                                                                                                                     | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB<br>FLOOR DRAIN<br>FOUNDATION<br>FIRE EXTINGUISHER<br>FIRE EXTINGUISHER<br>FIRE EXTINGUISHER CABINET<br>FINISH FLOOR<br>FLAT HEAD                                                                                                                                                                                                                                                                                                                                            | PA<br>PART BD<br>PC<br>PERIM<br>PERP<br>P.L.<br>PL<br>PLAM<br>PLAS<br>PLBG                                                                                                                               | PI<br>P/<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI                              |
| EWC<br>EXH<br>EXP<br>EXT<br>F.A.<br>FAB<br>FBO<br>F.C.<br>F.D.<br>FDTN<br>FE<br>F.E.C.<br>FF<br>F.H.<br>FH<br>FIN                                                                                                                                                   | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB<br>FLOOR DRAIN<br>FOUNDATION<br>FIRE EXTINGUISHER<br>FIRE EXTINGUISHER CABINET<br>FINISH FLOOR<br>FLAT HEAD<br>FIRE HYDRANT<br>FINISH(ED)                                                                                                                                                                                                                                                                                                                                   | PA<br>PART BD<br>PC<br>PERIM<br>PERP<br>P.L.<br>PL<br>PLAM<br>PLAS<br>PLBG<br>PLYWD<br>PNL                                                                                                               | PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI                  |
| EWC<br>EXH<br>EXP<br>EXT<br>EXT<br>F.A.<br>FAB<br>FBO<br>F.C.<br>F.D.<br>FDTN<br>FE<br>F.E.C.<br>FF<br>F.H.<br>FH<br>FIN<br>FIN                                                                                                                                     | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB<br>FLOOR DRAIN<br>FOUNDATION<br>FIRE EXTINGUISHER<br>FIRE EXTINGUISHER<br>FIRE EXTINGUISHER CABINET<br>FINISH FLOOR<br>FLAT HEAD<br>FIRE HYDRANT<br>EINISH(ED)                                                                                                                                                                                                                                                                                                              | PA<br>PART BD<br>PC<br>PERIM<br>PERP<br>P.L.<br>PL<br>PLAM<br>PLAS<br>PLBG<br>PLYWD                                                                                                                      | PI<br>P/<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI            |
| E/W<br>EWC<br>EXH<br>EXP<br>EXT<br>EXT<br>E.A.<br>FAB<br>FBO<br>F.C.<br>F.D.<br>FDTN<br>FE<br>F.E.C.<br>FF<br>F.H.<br>FIN<br>FIXT<br>FLASH<br>FLEX<br>FLR                                                                                                           | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB<br>FLOOR DRAIN<br>FOUNDATION<br>FIRE EXTINGUISHER<br>FIRE EXTINGUISHER CABINET<br>FINISH FLOOR<br>FLAT HEAD<br>FIRE HYDRANT<br>FINISH(ED)<br>FIXTURE<br>FLASHING<br>FLEXIBLE                                                                                                                                                                                                                                                                                                | PA<br>PART BD<br>PC<br>PERIM<br>PERP<br>P.L.<br>PL<br>PLAM<br>PLAS<br>PLBG<br>PLYWD<br>PNL<br>PORC<br>PR<br>PREFAB                                                                                       | PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>P |
| EWC<br>EXH<br>EXP<br>EXT<br>EXT<br>F.A.<br>FAB<br>FBO<br>F.C.<br>F.D.<br>FDTN<br>FE<br>F.C.<br>FDTN<br>FE<br>F.E.C.<br>FF<br>F.H.<br>FIN<br>FIXT<br>FLASH<br>FLR<br>FLR<br>FLR<br>FLUOR                                                                             | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB<br>FLOOR DRAIN<br>FOUNDATION<br>FIRE EXTINGUISHER<br>FIRE EXTINGUISHER CABINET<br>FINISH FLOOR<br>FLAT HEAD<br>FIRE HYDRANT<br>FINISH(ED)<br>FIXTURE<br>FLASHING<br>FLEXIBLE<br>FLOOR<br>FLUORESCENT                                                                                                                                                                                                                                                                        | PA<br>PART BD<br>PC<br>PERIM<br>PERP<br>P.L.<br>PL<br>PLAM<br>PLAS<br>PLBG<br>PLYWD<br>PNL<br>PORC<br>PR<br>PREFAB<br>PREFIN<br>PREP                                                                     | PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>P |
| EWC<br>EXH<br>EXP<br>EXT<br>EXT<br>F.A.<br>FAB<br>FBO<br>F.C.<br>FDTN<br>FE<br>F.E.C.<br>FF<br>F.H.<br>FH<br>FIN<br>FLASH<br>FLASH<br>FLUOR<br>FM                                                                                                                   | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB<br>FLOOR DRAIN<br>FOUNDATION<br>FIRE EXTINGUISHER<br>FIRE EXTINGUISHER CABINET<br>FINISH FLOOR<br>FLAT HEAD<br>FIRE HYDRANT<br>FINISH(ED)<br>FIXTURE<br>FLASHING<br>FLEXIBLE<br>FLOOR<br>FLUORESCENT                                                                                                                                                                                                                                                                        | PA<br>PART BD<br>PC<br>PERIM<br>PERP<br>P.L.<br>PL<br>PLAM<br>PLAS<br>PLBG<br>PLYWD<br>PNL<br>PORC<br>PR<br>PREFAB<br>PREFIN                                                                             | PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>P |
| EWC<br>EXH<br>EXP<br>EXT<br>EXT<br>F.A.<br>FAB<br>FBO<br>F.C.<br>F.D.<br>FDTN<br>FE<br>F.C.<br>F.T.<br>F.H.<br>FH<br>FIN<br>FIXT<br>FLASH<br>FLEX<br>FLR<br>FLUOR<br>FM<br>FO<br>F.O.C.                                                                             | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB<br>FLOOR DRAIN<br>FOUNDATION<br>FIRE EXTINGUISHER<br>FIRE EXTINGUISHER CABINET<br>FIRE EXTINGUISHER CABINET<br>FINISH FLOOR<br>FLAT HEAD<br>FIRE HYDRANT<br>FINISH(ED)<br>FIXTURE<br>FLASHING<br>FLEXIBLE<br>FLOOR<br>FLUORESCENT<br>FACTORY MUTUAL<br>FINISHED OPENING<br>FACE OF CONCRETE<br>FACE OF CONCRETE<br>FACE OF EINISH                                                                                                                                           | PA<br>PART BD<br>PC<br>PERIM<br>PERP<br>P.L.<br>PL<br>PLAM<br>PLAS<br>PLBG<br>PLYWD<br>PNL<br>PORC<br>PR<br>PREFAB<br>PREFAB<br>PREFIN<br>PREP<br>PROJ<br>PROP<br>PSF                                    | PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>P |
| EWC<br>EXH<br>EXP<br>EXT<br>F.A.<br>FAB<br>FBO<br>F.C.<br>FDTN<br>FE<br>F.C.<br>FF<br>F.H.<br>FH<br>FIN<br>FLEX<br>FLASH<br>FLEX<br>FLUOR<br>FM<br>FO<br>F.O.C.<br>F.O.F.<br>F.O.M.                                                                                 | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB<br>FLOOR DRAIN<br>FOUNDATION<br>FIRE EXTINGUISHER<br>FIRE EXTINGUISHER CABINET<br>FINISH FLOOR<br>FLAT HEAD<br>FIRE HYDRANT<br>FINISH(ED)<br>FIXTURE<br>FLASHING<br>FLEXIBLE<br>FLOOR<br>FLUORESCENT<br>FACTORY MUTUAL<br>FINISHED OPENING<br>FACE OF CONCRETE<br>FACE OF FINISH<br>FACE OF MASONRY                                                                                                                                                                         | PA<br>PART BD<br>PC<br>PERIM<br>PERP<br>P.L.<br>PL<br>PLAM<br>PLAS<br>PLBG<br>PLYWD<br>PNL<br>PORC<br>PR<br>PREFAB<br>PREFAB<br>PREFIN<br>PREP<br>PROJ<br>PROP<br>PSF<br>PSI<br>PT                       | PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>P |
| EWC<br>EXH<br>EXP<br>EXT<br>F.A.<br>FAB<br>FBO<br>F.C.<br>F.D.<br>FDTN<br>FE<br>F.E.C.<br>FF<br>F.H.<br>FH<br>FIN<br>FIXT<br>FLASH<br>FLEX<br>FLR<br>FLUOR<br>FM<br>FO<br>F.O.C.<br>F.O.F.<br>F.O.M.<br>F.O.S.                                                      | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB<br>FLOOR DRAIN<br>FOUNDATION<br>FIRE EXTINGUISHER<br>FIRE EXTINGUISHER CABINET<br>FINISH FLOOR<br>FLAT HEAD<br>FIRE HYDRANT<br>FINISH(ED)<br>FIXTURE<br>FLASHING<br>FLEXIBLE<br>FLOOR<br>FLUORESCENT<br>FACTORY MUTUAL<br>FINISHED OPENING<br>FACE OF CONCRETE<br>FACE OF FINISH<br>FACE OF MASONRY<br>FACE OF STUD                                                                                                                                                         | PA<br>PART BD<br>PC<br>PERIM<br>PERP<br>P.L.<br>PL<br>PLAM<br>PLAS<br>PLBG<br>PLYWD<br>PNL<br>PORC<br>PR<br>PREFAB<br>PREFIN<br>PREP<br>PROJ<br>PROP<br>PSF<br>PSI                                       | 0<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI                   |
| EWC<br>EXH<br>EXP<br>EXT<br>EA.<br>FAB<br>BO<br>C.<br>FD<br>DTN<br>E<br>E.C.<br>F<br>F.<br>H.<br>FH<br>TN<br>TXT<br>ELASH<br>ELEX<br>ELUOR<br>M<br>CO<br>C.<br>C.<br>C.<br>F<br>C.<br>F<br>F.<br>H.<br>F<br>H.<br>F<br>H.<br>F<br>H.<br>F                           | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB<br>FLOOR DRAIN<br>FOUNDATION<br>FIRE EXTINGUISHER<br>FIRE EXTINGUISHER CABINET<br>FIRE EXTINGUISHER CABINET<br>FINISH FLOOR<br>FLAT HEAD<br>FIRE HYDRANT<br>FINISH(ED)<br>FIXTURE<br>FLASHING<br>FLEXIBLE<br>FLOOR<br>FLUORESCENT<br>FACTORY MUTUAL<br>FINISHED OPENING<br>FACE OF CONCRETE<br>FACE OF FINISH<br>FACE OF MASONRY<br>FACE OF STUD<br>FIREPROOF(ING)<br>FRAME / FIRE RESISTANT / RATED                                                                        | PA<br>PART BD<br>PC<br>PERIM<br>PERP<br>P.L.<br>PL<br>PLAM<br>PLAS<br>PLBG<br>PLYWD<br>PNL<br>PORC<br>PR<br>PREFAB<br>PREFAB<br>PREFIN<br>PREP<br>PROJ<br>PROP<br>PSF<br>PSI<br>PT<br>PVC                | PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>P |
| EWC<br>EXH<br>EXP<br>EXT<br>EA.<br>FAB<br>BO<br>C.<br>D.<br>DTN<br>E<br>E.C.<br>F<br>H.<br>H<br>IN<br>IXT<br>LASH<br>LEX<br>ELR<br>ELUOR<br>M<br>O<br>O.C.<br>O.F.<br>O.S.<br>P<br>R<br>R<br>R<br>P                                                                 | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB<br>FLOOR DRAIN<br>FOUNDATION<br>FIRE EXTINGUISHER<br>FIRE EXTINGUISHER CABINET<br>FIRE EXTINGUISHER CABINET<br>FINISH FLOOR<br>FLAT HEAD<br>FIRE HYDRANT<br>FINISH(ED)<br>FIXTURE<br>FLASHING<br>FLEXIBLE<br>FLOOR<br>FLUORESCENT<br>FACTORY MUTUAL<br>FINISHED OPENING<br>FACE OF CONCRETE<br>FACE OF FINISH<br>FACE OF MASONRY<br>FACE OF STUD<br>FIREPROOF(ING)                                                                                                          | PA<br>PART BD<br>PC<br>PERIM<br>PERP<br>P.L.<br>PL<br>PLAM<br>PLAS<br>PLBG<br>PLYWD<br>PNL<br>PORC<br>PR<br>PREFAB<br>PREFAB<br>PREFIN<br>PREP<br>PROJ<br>PROP<br>PSF<br>PSI<br>PT<br>PVC<br>PVMT        | PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>P |
| EWC<br>EXH<br>EXP<br>EXT<br>EXT<br>F.A.<br>FAB<br>FBO<br>F.C.<br>FDTN<br>FE<br>F.E.C.<br>FF<br>F.H.<br>TN<br>FIN<br>FIN<br>FLASH<br>FLUOR<br>FLUOR<br>FO.C.<br>F.O.F.<br>F.O.M.<br>FO.S.<br>FP<br>FR<br>FRP<br>FT<br>TG                                             | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB<br>FLOOR DRAIN<br>FOUNDATION<br>FIRE EXTINGUISHER<br>FIRE EXTINGUISHER CABINET<br>FIRE EXTINGUISHER CABINET<br>FINISH FLOOR<br>FLAT HEAD<br>FIRE HYDRANT<br>FINISH(ED)<br>FIXTURE<br>FLASHING<br>FLEXIBLE<br>FLOOR<br>FLUORESCENT<br>FACTORY MUTUAL<br>FINISHED OPENING<br>FACE OF CONCRETE<br>FACE OF FINISH<br>FACE OF FINISH<br>FACE OF STUD<br>FIREPROOF(ING)<br>FRAME / FIRE RESISTANT / RATED<br>FIBERGLASS REINFORCED PLASTIC<br>FOOT / FEET<br>FOOTING              | PA<br>PART BD<br>PC<br>PERIM<br>PERP<br>P.L.<br>PL<br>PLAM<br>PLAS<br>PLBG<br>PLYWD<br>PNL<br>PORC<br>PR<br>PREFAB<br>PREFAB<br>PREFIN<br>PREP<br>PROJ<br>PROP<br>PSF<br>PSI<br>PT<br>PVC<br>PVMT<br>PWR | PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>P |
| EWC<br>EXH<br>EXP<br>EXT<br>F.A.<br>FAB<br>FBO<br>F.C.<br>FDTN<br>FE<br>F.E.C.<br>FF<br>F.H.<br>FH<br>FIN<br>FIXT<br>FLASH<br>FLUOR<br>FM<br>FO<br>FO.C.<br>F.O.F.<br>F.O.M.<br>F.O.S.<br>FP<br>FR<br>FR<br>FR<br>FR<br>FR<br>FI<br>FURN                            | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB<br>FLOOR DRAIN<br>FOUNDATION<br>FIRE EXTINGUISHER<br>FIRE EXTINGUISHER CABINET<br>FINISH FLOOR<br>FLAT HEAD<br>FIRE HYDRANT<br>FINISH(ED)<br>FIXTURE<br>FLASHING<br>FLEXIBLE<br>FLOOR<br>FLUORESCENT<br>FACTORY MUTUAL<br>FINISHED OPENING<br>FACE OF CONCRETE<br>FACE OF FINISH<br>FACE OF FINISH<br>FACE OF STUD<br>FIREPROOF(ING)<br>FRAME / FIRE RESISTANT / RATED<br>FIBERGLASS REINFORCED PLASTIC<br>FOOT / FEET                                                      | PA<br>PART BD<br>PC<br>PERIM<br>PERP<br>P.L.<br>PL<br>PLAM<br>PLAS<br>PLBG<br>PLYWD<br>PNL<br>PORC<br>PR<br>PREFAB<br>PREFIN<br>PREP<br>PROJ<br>PROP<br>PSF<br>PSI<br>PT<br>PVC<br>PVMT<br>PWR           | PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>P |
| EWC<br>EXH<br>EXP<br>EXT<br>F.A.<br>FAB<br>FBO<br>F.C.<br>FDTN<br>FE<br>F.E.C.<br>FF<br>F.H.<br>FH<br>FIN<br>FIXT<br>FLASH<br>FLUOR<br>FM<br>FO<br>FO.C.<br>F.O.F.<br>F.O.M.<br>F.O.S.<br>FP<br>FR<br>FR<br>FR<br>FR<br>FR<br>FI<br>FURN                            | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB<br>FLOOR DRAIN<br>FOUNDATION<br>FIRE EXTINGUISHER<br>FIRE EXTINGUISHER CABINET<br>FIRE EXTINGUISHER CABINET<br>FINISH FLOOR<br>FLAT HEAD<br>FIRE HYDRANT<br>FINISH(ED)<br>FIXTURE<br>FLASHING<br>FLEXIBLE<br>FLOOR<br>FLUORESCENT<br>FACTORY MUTUAL<br>FINISHED OPENING<br>FACE OF CONCRETE<br>FACE OF FINISH<br>FACE OF FINISH<br>FACE OF STUD<br>FIREPROOF(ING)<br>FRAME / FIRE RESISTANT / RATED<br>FIBERGLASS REINFORCED PLASTIC<br>FOOT / FEET<br>FOOTING<br>FURNITURE | PA<br>PART BD<br>PC<br>PERIM<br>PERP<br>P.L.<br>PL<br>PLAM<br>PLAS<br>PLBG<br>PLYWD<br>PNL<br>PORC<br>PR<br>PREFAB<br>PREFIN<br>PREP<br>PROJ<br>PROP<br>PSF<br>PSI<br>PT<br>PVC<br>PVMT<br>PWR           | PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>P |
| EWC<br>EXH<br>EXP<br>EXT<br>EXT<br>F.A.<br>FAB<br>FBO<br>F.C.<br>F.D.<br>FDTN<br>FE<br>F.E.C.<br>FF<br>F.H.<br>FH<br>FIN<br>FIN<br>FIXT<br>FLASH<br>FLEX<br>FLR<br>FLUOR<br>FM<br>FO<br>F.O.C.<br>F.O.F.<br>F.O.M.<br>F.O.S.<br>FP<br>FR<br>FR<br>FT<br>FTG<br>FURN | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB<br>FLOOR DRAIN<br>FOUNDATION<br>FIRE EXTINGUISHER<br>FIRE EXTINGUISHER CABINET<br>FIRE EXTINGUISHER CABINET<br>FINISH FLOOR<br>FLAT HEAD<br>FIRE HYDRANT<br>FINISH(ED)<br>FIXTURE<br>FLASHING<br>FLEXIBLE<br>FLOOR<br>FLUORESCENT<br>FACTORY MUTUAL<br>FINISHED OPENING<br>FACE OF CONCRETE<br>FACE OF FINISH<br>FACE OF FINISH<br>FACE OF STUD<br>FIREPROOF(ING)<br>FRAME / FIRE RESISTANT / RATED<br>FIBERGLASS REINFORCED PLASTIC<br>FOOT / FEET<br>FOOTING<br>FURNITURE | PA<br>PART BD<br>PC<br>PERIM<br>PERP<br>P.L.<br>PL<br>PLAM<br>PLAS<br>PLBG<br>PLYWD<br>PNL<br>PORC<br>PR<br>PREFAB<br>PREFIN<br>PREP<br>PROJ<br>PROP<br>PSF<br>PSI<br>PT<br>PVC<br>PVMT<br>PWR           | PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>P |
| EWC<br>EXH<br>EXP<br>EXT<br>F.A.<br>FAB<br>FBO<br>F.C.<br>FDTN<br>FE<br>F.E.C.<br>FF<br>F.H.<br>FH<br>FIN<br>FIXT<br>FLASH<br>FLUOR<br>FM<br>FO<br>FO.C.<br>F.O.F.<br>F.O.M.<br>F.O.S.<br>FP<br>FR<br>FR<br>FR<br>FR<br>FR<br>FI<br>FURN                            | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB<br>FLOOR DRAIN<br>FOUNDATION<br>FIRE EXTINGUISHER<br>FIRE EXTINGUISHER CABINET<br>FIRE EXTINGUISHER CABINET<br>FINISH FLOOR<br>FLAT HEAD<br>FIRE HYDRANT<br>FINISH(ED)<br>FIXTURE<br>FLASHING<br>FLEXIBLE<br>FLOOR<br>FLUORESCENT<br>FACTORY MUTUAL<br>FINISHED OPENING<br>FACE OF CONCRETE<br>FACE OF FINISH<br>FACE OF FINISH<br>FACE OF STUD<br>FIREPROOF(ING)<br>FRAME / FIRE RESISTANT / RATED<br>FIBERGLASS REINFORCED PLASTIC<br>FOOT / FEET<br>FOOTING<br>FURNITURE | PA<br>PART BD<br>PC<br>PERIM<br>PERP<br>P.L.<br>PL<br>PLAM<br>PLAS<br>PLBG<br>PLYWD<br>PNL<br>PORC<br>PR<br>PREFAB<br>PREFIN<br>PREP<br>PROJ<br>PROP<br>PSF<br>PSI<br>PT<br>PVC<br>PVMT<br>PWR           | PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>P |
| EWC<br>EXH<br>EXP<br>EXT<br>EXT<br>F.A.<br>FAB<br>FBO<br>F.C.<br>F.D.<br>FDTN<br>FE<br>F.E.C.<br>FF<br>F.H.<br>FH<br>FIN<br>FIXT<br>FLASH                                                                                                                           | EXTERIOR<br>FIRE ALARM<br>FABRICATE(D)<br>FINISHED BY OTHERS<br>FACE OF CURB<br>FLOOR DRAIN<br>FOUNDATION<br>FIRE EXTINGUISHER<br>FIRE EXTINGUISHER CABINET<br>FIRE EXTINGUISHER CABINET<br>FINISH FLOOR<br>FLAT HEAD<br>FIRE HYDRANT<br>FINISH(ED)<br>FIXTURE<br>FLASHING<br>FLEXIBLE<br>FLOOR<br>FLUORESCENT<br>FACTORY MUTUAL<br>FINISHED OPENING<br>FACE OF CONCRETE<br>FACE OF FINISH<br>FACE OF FINISH<br>FACE OF STUD<br>FIREPROOF(ING)<br>FRAME / FIRE RESISTANT / RATED<br>FIBERGLASS REINFORCED PLASTIC<br>FOOT / FEET<br>FOOTING<br>FURNITURE | PA<br>PART BD<br>PC<br>PERIM<br>PERP<br>P.L.<br>PL<br>PLAM<br>PLAS<br>PLBG<br>PLYWD<br>PNL<br>PORC<br>PR<br>PREFAB<br>PREFIN<br>PREP<br>PROJ<br>PROP<br>PSF<br>PSI<br>PT<br>PVC<br>PVMT<br>PWR           | PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>PI<br>P |

|        | GALLON(S)<br>GALVANIZED                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | R<br>R.A.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | RADIUS<br>RETURN AIR                                                                                                                                                                                                                                                                      |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|        | GAGE<br>GENERAL CONTRACTOR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | RCP<br>R.D.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | REFLECTED CEILING PLAN<br>ROOF DRAIN                                                                                                                                                                                                                                                      |
|        | GENERAL / GENERATOR<br>GALVANIZED IRON                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | RE:<br>REBAR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | REFER TO / REFERENCE<br>REINFORCING BAR                                                                                                                                                                                                                                                   |
|        | GLASS<br>GRADE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | REC<br>REF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | RECESS(ED)<br>REFRIGERATOR                                                                                                                                                                                                                                                                |
|        | GYPSUM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | REG                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | REGISTER / REGULAR                                                                                                                                                                                                                                                                        |
|        | HIGH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | REINF<br>REM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | REINFORCE(ED)(ING)<br>REMOVE                                                                                                                                                                                                                                                              |
|        | HOSE BIB<br>HANDICAP, HOLLOW CORE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | RESIL<br>REQ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | RESILIENT<br>REQUIREMENTS / REQUIRED                                                                                                                                                                                                                                                      |
|        | HARD BOARD<br>HEADER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | REV<br>RFG                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | REVISION / REVISE(ED)<br>ROOFING                                                                                                                                                                                                                                                          |
|        | HARDWARE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | RH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | RIGHT HAND                                                                                                                                                                                                                                                                                |
|        | HARDWOOD<br>HEIGHT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | RHR<br>RM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | RIGHT HAND REVERSE<br>ROOM                                                                                                                                                                                                                                                                |
|        | HOLLOW METAL<br>HORIZONTAL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | R.O.<br>R.O.W.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ROUGH OPENING<br>RIGHT OF WAY                                                                                                                                                                                                                                                             |
|        | HIGH POINT<br>HOUR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | R/S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ROUGH SAWN                                                                                                                                                                                                                                                                                |
|        | HEATING VENTILATING AND<br>AIR CONDITIONING                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | S<br>S.A.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | SOUTH<br>SUPPLY AIR                                                                                                                                                                                                                                                                       |
|        | HOT WATER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | SAG                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | SUSPENDED ACOUSTICAL GRID                                                                                                                                                                                                                                                                 |
|        | INTERNATIONAL BUILDING CODE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | SAN<br>SC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | SANITARY<br>SOLID CORE                                                                                                                                                                                                                                                                    |
|        | INSIDE DIAMETER<br>INCH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | SCHED<br>SEC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | SCHEDULE<br>SECOND                                                                                                                                                                                                                                                                        |
| D      | INCANDESCENT<br>INCLUDE(D)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | SECT<br>SF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | SECTION<br>SQUARE FEET                                                                                                                                                                                                                                                                    |
|        | INFORMATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | SHT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | SHEET                                                                                                                                                                                                                                                                                     |
|        | INSULATION<br>INTERIOR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | SIM<br>SM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | SIMILAR<br>SHEET METAL / SMALL                                                                                                                                                                                                                                                            |
|        | INVERT<br>IRRIGATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | SS<br>SHWR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | STAINLESS STEEL<br>SHOWER                                                                                                                                                                                                                                                                 |
|        | JANITOR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | SPEC<br>SPKLR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | SPECIFICATION<br>SPRINKLER                                                                                                                                                                                                                                                                |
|        | JOINT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | SQ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | SQUARE                                                                                                                                                                                                                                                                                    |
|        | KITCHEN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | ST<br>STA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | STAIN, STREET<br>STATION                                                                                                                                                                                                                                                                  |
|        | LOW                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | STC<br>STD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | SOUND TRANSMISSION CLASS<br>STANDARD                                                                                                                                                                                                                                                      |
|        | LABORATORY<br>LAMINATE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | STL<br>STOR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | STEEL<br>STORAGE                                                                                                                                                                                                                                                                          |
|        | LAVATORY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | STRUCT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | STRUCTURE(AL)                                                                                                                                                                                                                                                                             |
|        | POUND<br>LEADER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | SUSP<br>SV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | SUSPEND(ED)(SION)<br>SHEET VINYL                                                                                                                                                                                                                                                          |
|        | LINEAR FEET<br>LEFT HAND                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | S.Y.<br>SYN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | SQUARE YARD<br>SYNTHETIC                                                                                                                                                                                                                                                                  |
|        | LEFT HAND REVERSE<br>LONG LEG HORIZONTAL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | SYS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | SYSTEM                                                                                                                                                                                                                                                                                    |
|        | LONG LEG VERTICAL<br>LOW POINT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | T<br>T&B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | TREAD(S)<br>TOP AND BOTTOM                                                                                                                                                                                                                                                                |
|        | LIGHTWEIGHT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | TB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | TACKBOARD                                                                                                                                                                                                                                                                                 |
|        | LEVEL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | TBD<br>T.C.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | TO BE DETERMINED<br>TOP OF CURB                                                                                                                                                                                                                                                           |
|        | MAINTENANCE<br>MASONRY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | TEL<br>TEMP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | TELEPHONE<br>TEMPERATURE / TEMPORARY                                                                                                                                                                                                                                                      |
|        | MATERIAL<br>MAXIMUM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | T&G<br>THK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | TONGUE AND GROOVE<br>THICK(NESS)                                                                                                                                                                                                                                                          |
|        | MECHANICAL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | T.O.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | TOP OF                                                                                                                                                                                                                                                                                    |
|        | MEDIUM<br>MEMBRANE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | T.O.C.<br>T.O.F.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | TOP OF CONCRETE<br>TOP OF FRAMING                                                                                                                                                                                                                                                         |
|        | MEZZANINE<br>MANUFACTURER(ED)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | T.O.S.<br>T.O.W.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | TOP OF STEEL / STUD<br>TOP OF WALL                                                                                                                                                                                                                                                        |
|        | MINIMUM, MINUTE<br>MISCELLANEOUS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | TRANSF<br>TS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | TRANSFORMER<br>TUBE STEEL                                                                                                                                                                                                                                                                 |
|        | MOULDING<br>MILLWORK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | TV<br>TYP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | TELEVISION                                                                                                                                                                                                                                                                                |
|        | MASONRY OPENING                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | TYPICAL                                                                                                                                                                                                                                                                                   |
|        | MOUNT(ED)<br>METAL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | UBC<br>UL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | UNIFORM BUILDING CODE<br>UNDERWRITERS LABORATORIES                                                                                                                                                                                                                                        |
|        | MOUNTING<br>MULLION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | UNO<br>UON                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | UNLESS NOTED OTHERWISE<br>UNLESS OTHERWISE NOTED                                                                                                                                                                                                                                          |
|        | MULTIPLE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | UTIL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | UTILITIES                                                                                                                                                                                                                                                                                 |
|        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | V.B.<br>VCT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                           |
|        | NOT APPLICABLE<br>NEGATIVE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | VERT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | VINYL COMPOSITION TILE<br>VERTICAL                                                                                                                                                                                                                                                        |
|        | NATIONAL FIRE PROTECTION AGENCY<br>NOT IN CONTRACT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | VIF<br>VTR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | VERIFY IN FIELD<br>VENT-THRU ROOF                                                                                                                                                                                                                                                         |
|        | NUMBER<br>NOMINAL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | VWC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | VINYL WALL COVERING                                                                                                                                                                                                                                                                       |
|        | NOISE REDUCTION COEFFICIENT<br>NOT TO SCALE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | W<br>(W)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | WEST<br>WIDE                                                                                                                                                                                                                                                                              |
|        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | W.C.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | WATER CLOSET                                                                                                                                                                                                                                                                              |
|        | ON CENTER<br>OUTSIDE DIAMETER / DIMENSION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | WD<br>WDW                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | WASHER / DRYER COMBO<br>WINDOW                                                                                                                                                                                                                                                            |
|        | OWNER FURNISHED /<br>CONTRACTOR INSTALLED                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | WH<br>W.R.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | WATER HEATER<br>WATER RESISTANT                                                                                                                                                                                                                                                           |
|        | OWNER FURNISHED /<br>OWNER INSTALLED                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | WWF<br>W/                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | WELDED WIRE FABRIC                                                                                                                                                                                                                                                                        |
|        | OVERHEAD, OVERHANG<br>OPPOSITE HAND                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | W/I<br>W/O                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | WITHIN<br>WITHOUT                                                                                                                                                                                                                                                                         |
|        | OPENING                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | WD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | WOOD                                                                                                                                                                                                                                                                                      |
|        | OPPOSITE<br>OVERFLOW ROOF DRAIN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | WP<br>WGT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | WEATHERPROOF, WORKING POI<br>WEIGHT                                                                                                                                                                                                                                                       |
|        | ORIGINAL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                           |
|        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | YD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | YARD                                                                                                                                                                                                                                                                                      |
| 3D     | PUBLIC ADDRESS<br>PARTICLE BOARD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | YD<br>YR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | YARD<br>YEAR                                                                                                                                                                                                                                                                              |
| 3D     | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                           |
| 3D     | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST<br>PERIMETER<br>PERPENDICULAR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                           |
| 3D     | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST<br>PERIMETER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                           |
| 3D     | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST<br>PERIMETER<br>PERPENDICULAR<br>PROPERTY LINE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                           |
| 3D     | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST<br>PERIMETER<br>PERPENDICULAR<br>PROPERTY LINE<br>PLATE<br>PLATE<br>PLASTIC LAMINATE<br>PLASTIC / PLASTER<br>PLUMBLING                                                                                                                                                                                                                                                                                                                                                                                                                                           | YR<br><br>&<br>&<br>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | YEAR<br>AND<br>ANGLE                                                                                                                                                                                                                                                                      |
| 3D     | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST<br>PERIMETER<br>PERPENDICULAR<br>PROPERTY LINE<br>PLATE<br>PLASTIC LAMINATE<br>PLASTIC / PLASTER<br>PLUMBLING<br>PLYWOOD<br>PANEL                                                                                                                                                                                                                                                                                                                                                                                                                                | YR<br><br>&<br><br>@<br><br>X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | YEAR<br>AND<br>ANGLE<br>AT<br>BY / MULTIPLY                                                                                                                                                                                                                                               |
| 3D     | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST<br>PERIMETER<br>PERPENDICULAR<br>PROPERTY LINE<br>PLATE<br>PLASTIC LAMINATE<br>PLASTIC / PLASTER<br>PLUMBLING<br>PLYWOOD                                                                                                                                                                                                                                                                                                                                                                                                                                         | YR<br>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | YEAR<br>AND<br>ANGLE<br>AT                                                                                                                                                                                                                                                                |
| 3D<br> | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST<br>PERIMETER<br>PERPENDICULAR<br>PROPERTY LINE<br>PLATE<br>PLATE<br>PLASTIC LAMINATE<br>PLASTIC / PLASTER<br>PLUMBLING<br>PLYWOOD<br>PANEL<br>PORCELAIN                                                                                                                                                                                                                                                                                                                                                                                                          | YR<br><br>&<br><br>@<br><br>X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | YEAR<br>AND<br>ANGLE<br>AT<br>BY / MULTIPLY<br>CENTERLINE                                                                                                                                                                                                                                 |
| )<br>B | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST<br>PERIMETER<br>PERPENDICULAR<br>PROPERTY LINE<br>PLATE<br>PLASTIC LAMINATE<br>PLASTIC / PLASTER<br>PLUMBLING<br>PLYWOOD<br>PANEL<br>PORCELAIN<br>PAIR<br>PREFABRICATE(D)                                                                                                                                                                                                                                                                                                                                                                                        | YR<br>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | YEAR<br>AND<br>ANGLE<br>AT<br>BY / MULTIPLY<br>CENTERLINE<br>DEGREE<br>DIAMETER                                                                                                                                                                                                           |
| )<br>B | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST<br>PERIMETER<br>PERPENDICULAR<br>PROPERTY LINE<br>PLATE<br>PLASTIC LAMINATE<br>PLASTIC / PLASTER<br>PLUMBLING<br>PLYWOOD<br>PANEL<br>PORCELAIN<br>PAIR<br>PREFABRICATE(D)<br>PREFINISH(ED)<br>PREPARATION / PREPARE<br>PROJECT<br>PROPERTY                                                                                                                                                                                                                                                                                                                       | YR<br>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | YEAR<br>AND<br>ANGLE<br>AT<br>BY / MULTIPLY<br>CENTERLINE<br>DEGREE<br>DIAMETER<br>DIVIDE<br>FEET<br>GREATER THAN<br>GREATER THAN OR EQUAL TO                                                                                                                                             |
| )<br>B | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST<br>PERIMETER<br>PERPENDICULAR<br>PROPERTY LINE<br>PLATE<br>PLATE<br>PLASTIC LAMINATE<br>PLASTIC / PLASTER<br>PLUMBLING<br>PLYWOOD<br>PANEL<br>PORCELAIN<br>PAIR<br>PREFABRICATE(D)<br>PREFINISH(ED)<br>PREPARATION / PREPARE<br>PROJECT<br>PROPERTY<br>POUNDS PER SQUARE FEET<br>POUNDS PER SQUARE INCH                                                                                                                                                                                                                                                          | YR<br>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | YEAR<br>AND<br>ANGLE<br>AT<br>BY / MULTIPLY<br>CENTERLINE<br>DEGREE<br>DIAMETER<br>DIVIDE<br>FEET<br>GREATER THAN<br>GREATER THAN<br>GREATER THAN OR EQUAL TO<br>INCHES<br>LESS THAN                                                                                                      |
| )<br>B | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST<br>PERIMETER<br>PERPENDICULAR<br>PROPERTY LINE<br>PLATE<br>PLATE<br>PLASTIC LAMINATE<br>PLASTIC / PLASTER<br>PLUMBLING<br>PLYWOOD<br>PANEL<br>PORCELAIN<br>PAIR<br>PREFABRICATE(D)<br>PREFINISH(ED)<br>PREFABRICATE(D)<br>PREPARATION / PREPARE<br>PROJECT<br>PROPERTY<br>POUNDS PER SQUARE FEET<br>POUNDS PER SQUARE INCH<br>PAINT, POINT, PRESSURE TREATED<br>POLYVINYL CHLORIDE                                                                                                                                                                               | YR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | YEAR<br>AND<br>ANGLE<br>AT<br>BY / MULTIPLY<br>CENTERLINE<br>DEGREE<br>DIAMETER<br>DIVIDE<br>FEET<br>GREATER THAN<br>GREATER THAN<br>GREATER THAN OR EQUAL TO<br>INCHES<br>LESS THAN<br>LESS THAN OR EQUAL TO<br>NUMBER / POUND                                                           |
| )<br>B | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST<br>PERIMETER<br>PERPENDICULAR<br>PROPERTY LINE<br>PLATE<br>PLATE<br>PLASTIC LAMINATE<br>PLASTIC LAMINATE<br>PLASTIC / PLASTER<br>PLUMBLING<br>PLYWOOD<br>PANEL<br>PORCELAIN<br>PAIR<br>PREFABRICATE(D)<br>PREFINISH(ED)<br>PREFARATION / PREPARE<br>PROJECT<br>PROPERTY<br>POUNDS PER SQUARE FEET<br>POUNDS PER SQUARE INCH<br>PAINT, POINT, PRESSURE TREATED                                                                                                                                                                                                    | YR<br>×<br>∞<br>×<br>√<br>∞<br>×<br>×<br>×<br>×<br>×<br>×<br>×<br>×<br>×<br>×<br>×<br>×<br>×                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | YEAR<br>AND<br>ANGLE<br>AT<br>BY / MULTIPLY<br>CENTERLINE<br>DEGREE<br>DIAMETER<br>DIVIDE<br>FEET<br>GREATER THAN<br>GREATER THAN<br>GREATER THAN<br>CIESS THAN<br>LESS THAN OR EQUAL TO                                                                                                  |
| )<br>B | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST<br>PERIMETER<br>PERPENDICULAR<br>PROPERTY LINE<br>PLATE<br>PLASTIC LAMINATE<br>PLASTIC / PLASTER<br>PLUMBLING<br>PLYWOOD<br>PANEL<br>PORCELAIN<br>PAIR<br>PREFABRICATE(D)<br>PREFINISH(ED)<br>PREFABRICATE(D)<br>PREFABRICATE(D)<br>PREPARATION / PREPARE<br>PROJECT<br>PROPERTY<br>POUNDS PER SQUARE FEET<br>POUNDS PER SQUARE FEET<br>POUNDS PER SQUARE INCH<br>PAINT, POINT, PRESSURE TREATED<br>POLYVINYL CHLORIDE<br>PAVEMENT<br>POWER                                                                                                                      | YR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | YEAR<br>AND<br>AND<br>ANGLE<br>AT<br>BY / MULTIPLY<br>CENTERLINE<br>DEGREE<br>DIAMETER<br>DIVIDE<br>FEET<br>GREATER THAN<br>GREATER THAN<br>GREATER THAN OR EQUAL TO<br>INCHES<br>LESS THAN<br>LESS THAN OR EQUAL TO<br>NUMBER / POUND<br>PERCENT                                         |
| )<br>B | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST<br>PERIMETER<br>PERPENDICULAR<br>PROPERTY LINE<br>PLATE<br>PLASTIC LAMINATE<br>PLASTIC / PLASTER<br>PLUMBLING<br>PLYWOOD<br>PANEL<br>PORCELAIN<br>PAIR<br>PREFABRICATE(D)<br>PREFINISH(ED)<br>PREFINISH(ED)<br>PREPARATION / PREPARE<br>PROJECT<br>PROPERTY<br>POUNDS PER SQUARE FEET<br>POUNDS PER SQUARE INCH<br>PAINT, POINT, PRESSURE TREATED<br>POLYVINYL CHLORIDE<br>PAVEMENT                                                                                                                                                                              | YR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | YEAR<br>AND<br>ANGLE<br>AT<br>BY / MULTIPLY<br>CENTERLINE<br>DEGREE<br>DIAMETER<br>DIVIDE<br>FEET<br>GREATER THAN<br>GREATER THAN<br>GREATER THAN OR EQUAL TO<br>INCHES<br>LESS THAN<br>LESS THAN OR EQUAL TO<br>NUMBER / POUND<br>PERCENT<br>APPROXIMATELY                               |
| )<br>B | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST<br>PERIMETER<br>PERPENDICULAR<br>PROPERTY LINE<br>PLATE<br>PLATE<br>PLASTIC LAMINATE<br>PLASTIC / PLASTER<br>PLUMBLING<br>PLYWOOD<br>PANEL<br>PORCELAIN<br>PAIR<br>PREFABRICATE(D)<br>PREFINISH(ED)<br>PREFINISH(ED)<br>PREPARATION / PREPARE<br>PROJECT<br>PROPERTY<br>POUNDS PER SQUARE FEET<br>POUNDS PER SQUARE FEET<br>POUNDS PER SQUARE INCH<br>PAINT, POINT, PRESSURE TREATED<br>POLYVINYL CHLORIDE<br>PAVEMENT<br>POWER<br>QUANTITY                                                                                                                      | YR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | YEAR<br>AND<br>ANGLE<br>AT<br>BY / MULTIPLY<br>CENTERLINE<br>DEGREE<br>DIAMETER<br>DIVIDE<br>FEET<br>GREATER THAN<br>GREATER THAN<br>GREATER THAN OR EQUAL TO<br>INCHES<br>LESS THAN<br>LESS THAN OR EQUAL TO<br>NUMBER / POUND<br>PERCENT<br>APPROXIMATELY                               |
| B<br>1 | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST<br>PERIMETER<br>PERPENDICULAR<br>PROPERTY LINE<br>PLATE<br>PLATE<br>PLASTIC LAMINATE<br>PLASTIC / PLASTER<br>PLUMBLING<br>PLYWOOD<br>PANEL<br>PORCELAIN<br>PAIR<br>PREFABRICATE(D)<br>PREFINISH(ED)<br>PREFINISH(ED)<br>PREPARATION / PREPARE<br>PROJECT<br>PROPERTY<br>POUNDS PER SQUARE FEET<br>POUNDS PER SQUARE FEET<br>POUNDS PER SQUARE INCH<br>PAINT, POINT, PRESSURE TREATED<br>POLYVINYL CHLORIDE<br>PAVEMENT<br>POWER<br>QUANTITY                                                                                                                      | YR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | YEAR<br>AND<br>ANGLE<br>AT<br>BY / MULTIPLY<br>CENTERLINE<br>DEGREE<br>DIAMETER<br>DIVIDE<br>FEET<br>GREATER THAN<br>GREATER THAN<br>GREATER THAN OR EQUAL TO<br>INCHES<br>LESS THAN<br>LESS THAN OR EQUAL TO<br>NUMBER / POUND<br>PERCENT<br>APPROXIMATELY                               |
| B<br>J | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST<br>PERIMETER<br>PERPENDICULAR<br>PROPERTY LINE<br>PLATE<br>PLASTIC LAMINATE<br>PLASTIC / PLASTER<br>PLUMBLING<br>PLYWOOD<br>PANEL<br>PORCELAIN<br>PAIR<br>PREFABRICATE(D)<br>PREFINISH(ED)<br>PREPARATION / PREPARE<br>PROJECT<br>PROPERTY<br>POUNDS PER SQUARE FEET<br>POUNDS PER SQUARE FEET<br>POUNDS PER SQUARE INCH<br>PAINT, POINT, PRESSURE TREATED<br>POLYVINYL CHLORIDE<br>PAVEMENT<br>POWER<br>QUANTITY<br>QUARRY TILE                                                                                                                                 | YR<br>&<br>&<br>X<br>Q<br>X<br>Q<br>X<br>Q<br>X<br>Q<br>X<br>Q<br>X<br>Q<br>X<br>Q<br>X<br>Q<br>X<br>Q<br>X<br>Q<br>X<br>Q<br>X<br>Q<br>X<br>Q<br>X<br>Q<br>X<br>Q<br>X<br>Q<br>X<br>Z<br>Z<br>Z<br>Z<br>Z<br>Z<br>Z<br>Z<br>Z<br>Z<br>Z<br>Z<br>Z                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | YEAR<br>AND<br>ANGLE<br>AT<br>BY / MULTIPLY<br>CENTERLINE<br>DEGREE<br>DIAMETER<br>DIVIDE<br>FEET<br>GREATER THAN<br>GREATER THAN<br>GREATER THAN OR EQUAL TO<br>INCHES<br>LESS THAN<br>LESS THAN<br>LESS THAN OR EQUAL TO<br>NUMBER / POUND<br>PERCENT<br>APPROXIMATELY<br>PROPERTY LINE |
| B<br>J | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST<br>PERIMETER<br>PERPENDICULAR<br>PROPERTY LINE<br>PLATE<br>PLASTIC LAMINATE<br>PLASTIC / PLASTER<br>PLUMBLING<br>PLYWOOD<br>PANEL<br>PORCELAIN<br>PAIR<br>PREFABRICATE(D)<br>PREFINISH(ED)<br>PREFINISH(ED)<br>PREPARATION / PREPARE<br>PROJECT<br>PROPERTY<br>POUNDS PER SQUARE FEET<br>POUNDS PER SQUARE FEET<br>POUNDS PER SQUARE INCH<br>PAINT, POINT, PRESSURE TREATED<br>POLYVINYL CHLORIDE<br>PAVEMENT<br>POWER<br>QUANTITY<br>QUARRY TILE                                                                                                                | YR<br>&<br>&<br>&<br>X<br>Q<br>C<br>C<br>X<br>Q<br>X<br>Q<br>X<br>Q<br>X<br>Q<br>X<br>Q<br>X<br>Q<br>X<br>Q<br>X<br>Y<br>X<br>Q<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>Y<br>X<br>X<br>Y<br>X<br>X<br>Y<br>X<br>X<br>X<br>X<br>X<br>X<br>X<br>X<br>X<br>X<br>X<br>X<br>X | YEAR<br>AND<br>ANGLE<br>AT<br>BY / MULTIPLY<br>CENTERLINE<br>DEGREE<br>DIAMETER<br>DIVIDE<br>FEET<br>GREATER THAN<br>GREATER THAN<br>GREATER THAN OR EQUAL TO<br>INCHES<br>LESS THAN<br>LESS THAN<br>LESS THAN OR EQUAL TO<br>NUMBER / POUND<br>PERCENT<br>APPROXIMATELY<br>PROPERTY LINE |
|        | PUBLIC ADDRESS<br>PARTICLE BOARD<br>PRECAST<br>PERIMETER<br>PERPENDICULAR<br>PROPERTY LINE<br>PLATE<br>PLATE<br>PLASTIC LAMINATE<br>PLASTIC / PLASTER<br>PLUMBLING<br>PLYWOOD<br>PANEL<br>PORCELAIN<br>PAIR<br>PREFABRICATE(D)<br>PREFINISH(ED)<br>PREFABRICATE(D)<br>PREFABRICATE(D)<br>PREPARATION / PREPARE<br>PROJECT<br>PROPERTY<br>POUNDS PER SQUARE FEET<br>POUNDS PER SQUARE FEET<br>POUNDS PER SQUARE INCH<br>PAINT, POINT, PRESSURE TREATED<br>POLYVINYL CHLORIDE<br>PAVEMENT<br>POWER<br>QUANTITY<br>QUARRY TILE                                                                                  | YR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | YEAR<br>AND<br>ANGLE<br>AT<br>BY / MULTIPLY<br>CENTERLINE<br>DEGREE<br>DIAMETER<br>DIVIDE<br>FEET<br>GREATER THAN<br>GREATER THAN<br>GREATER THAN OR EQUAL TO<br>INCHES<br>LESS THAN<br>LESS THAN OR EQUAL TO<br>NUMBER / POUND<br>PERCENT<br>APPROXIMATELY<br>PROPERTY LINE              |
|        | PUBLIC ADDRESS         PARTICLE BOARD         PRECAST         PERIMETER         PERPENDICULAR         PROPERTY LINE         PLATE         PLASTIC LAMINATE         PLASTIC / PLASTER         PLUMBLING         PLYWOOD         PANEL         PORCELAIN         PAIR         PREFABRICATE(D)         PREFINISH(ED)         PREFABRICATE(D)         PREFARATION / PREPARE         PROJECT         PROPERTY         POUNDS PER SQUARE FEET         POUNDS PER SQUARE INCH         PAINT, POINT, PRESSURE TREATED         POLYVINYL CHLORIDE         PAVEMENT         POWER         QUANTITY         QUARRY TILE | YR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | YEAR<br>AND<br>ANGLE<br>AT<br>BY / MULTIPLY<br>CENTERLINE<br>DEGREE<br>DIAMETER<br>DIVIDE<br>FEET<br>GREATER THAN<br>GREATER THAN OR EQUAL TO<br>INCHES<br>LESS THAN<br>LESS THAN<br>LESS THAN OR EQUAL TO<br>NUMBER / POUND<br>PERCENT<br>APPROXIMATELY<br>PROPERTY LINE                 |
| B<br>J | PUBLIC ADDRESS         PARTICLE BOARD         PRECAST         PERIMETER         PERPENDICULAR         PROPERTY LINE         PLATE         PLASTIC LAMINATE         PLASTIC / PLASTER         PLUMBLING         PLYWOOD         PANEL         PORCELAIN         PAIR         PREFABRICATE(D)         PREFABRICATE(D)         PREFARATION / PREPARE         PROJECT         PROPERTY         POUNDS PER SQUARE FEET         POUNDS PER SQUARE INCH         PAINT, POINT, PRESSURE TREATED         POLYVINYL CHLORIDE         PAVEMENT         POWER         QUANTITY         QUARRY TILE                       | YR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | YEAR<br>AND<br>ANGLE<br>AT<br>BY / MULTIPLY<br>CENTERLINE<br>DEGREE<br>DIAMETER<br>DIVIDE<br>FEET<br>GREATER THAN<br>GREATER THAN OR EQUAL TO<br>INCHES<br>LESS THAN<br>LESS THAN OR EQUAL TO<br>NUMBER / POUND<br>PERCENT<br>APPROXIMATELY<br>PROPERTY LINE                              |
|        | PUBLIC ADDRESS         PARTICLE BOARD         PRECAST         PERIMETER         PERPENDICULAR         PROPERTY LINE         PLATE         PLASTIC LAMINATE         PLASTIC / PLASTER         PLUMBLING         PLYWOOD         PANEL         PORCELAIN         PAIR         PREFABRICATE(D)         PREFABRICATE(D)         PREFINISH(ED)         PREPARATION / PREPARE         PROJECT         PROPERTY         POUNDS PER SQUARE FEET         POUNDS PER SQUARE INCH         PAINT, POINT, PRESSURE TREATED         POLYVINYL CHLORIDE         PAVEMENT         POWER         QUANTITY         QUARRY TILE | YR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | YEAR<br>AND<br>ANGLE<br>AT<br>BY / MULTIPLY<br>CENTERLINE<br>DEGREE<br>DIAMETER<br>DIVIDE<br>FEET<br>GREATER THAN<br>GREATER THAN OR EQUAL TO<br>INCHES<br>LESS THAN<br>LESS THAN OR EQUAL TO<br>NUMBER / POUND<br>PERCENT<br>APPROXIMATELY<br>PROPERTY LINE                              |

|                  |                                       |                                                                                                                         |              | _                             |                                                                |
|------------------|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------|--------------|-------------------------------|----------------------------------------------------------------|
|                  | PLAN AND SEC                          | ΓΙΟΝ                                                                                                                    | 1)View       | <u>Name</u>                   | Drawing Title<br>Scale                                         |
| PLAN             |                                       | EARTH, UNDISTURBED                                                                                                      |              |                               | Building Section                                               |
| CE               |                                       |                                                                                                                         | SIM          |                               | <ul> <li>Direction of Sight</li> </ul>                         |
|                  | RESERVE<br>RESERVE                    | GRAVEL                                                                                                                  | A101         |                               | <ul> <li>Drawing Number</li> <li>Sheet Number</li> </ul>       |
|                  | LACK CK CK (                          |                                                                                                                         |              |                               | Wall Section                                                   |
|                  |                                       | CONCRETE, CAST IN PLACE, PRECAST                                                                                        | SIM          |                               | <ul> <li>Direction of Sight</li> <li>Drawing Number</li> </ul> |
| QUIRED           |                                       |                                                                                                                         | A101         |                               | <ul> <li>Sheet Number</li> </ul>                               |
| ))               |                                       | BRICK                                                                                                                   |              |                               | Detail Cut                                                     |
|                  |                                       |                                                                                                                         | ► SIM        |                               | <ul> <li>Direction of Sight</li> <li>Drawing Number</li> </ul> |
| Ξ                |                                       | CONCRETE MASONRY UNIT (CMU)                                                                                             | A10          |                               | <ul> <li>Sheet Number</li> </ul>                               |
|                  |                                       |                                                                                                                         | SIM          |                               |                                                                |
|                  |                                       | STONE                                                                                                                   | (1<br>(A101) |                               | Detail Callout_                                                |
|                  |                                       | WOOD (ROUGH)                                                                                                            |              | <u> </u>                      |                                                                |
| ICAL GRID        |                                       |                                                                                                                         |              |                               |                                                                |
|                  |                                       |                                                                                                                         |              |                               | Exterior Elevation<br>Direction of Sight                       |
|                  |                                       | BLOCKING OR SHIM                                                                                                        | A10          |                               | <ul> <li>Drawing Number</li> <li>Sheet Number</li> </ul>       |
|                  |                                       | WOOD (FINISH)                                                                                                           |              |                               |                                                                |
|                  |                                       |                                                                                                                         |              |                               | Interior Elevation<br>Direction of Sight                       |
|                  |                                       | SAND, PLASTER, MORTAR, GROUT                                                                                            | 2 (A101)     | le                            | <ul> <li>Drawing Number</li> </ul>                             |
|                  |                                       |                                                                                                                         |              |                               | <ul> <li>Sheet Number</li> </ul>                               |
|                  |                                       | METAL, STRUCTURAL STEEL STUDS                                                                                           |              | $\frown$                      |                                                                |
|                  |                                       |                                                                                                                         | 00.0 0       | 0.0                           | Column Centerline<br>Reference Grid & Bubble                   |
| N CLASS          |                                       | RIGID INSULATION                                                                                                        |              |                               |                                                                |
|                  | XXXXX                                 | BATT, LOOSE-FILL INSULATION                                                                                             |              | 0.0                           |                                                                |
|                  |                                       | DATT, LOOSE-FILE INSOLATION                                                                                             |              |                               |                                                                |
|                  |                                       |                                                                                                                         |              |                               |                                                                |
|                  | ELEVATION                             |                                                                                                                         |              |                               |                                                                |
|                  |                                       |                                                                                                                         |              | Room name                     | Room Tag<br>— Room Name                                        |
|                  |                                       | MASONRY                                                                                                                 |              | 888<br>150 SE                 | <ul> <li>Room Number</li> </ul>                                |
|                  |                                       |                                                                                                                         |              |                               | <ul> <li>Square Footage</li> </ul>                             |
|                  |                                       | SIDING                                                                                                                  |              | <1i>                          | Partition or Wall Type<br>Outer Line - Provide                 |
|                  |                                       | CONCRETE , GYPSUM BOARD,                                                                                                |              | Ť                             | Acoustical Batt.                                               |
| PORARY<br>/E     |                                       | PLASTER                                                                                                                 |              |                               |                                                                |
|                  |                                       | TILE                                                                                                                    |              | 8889                          | Door Number                                                    |
|                  |                                       |                                                                                                                         |              |                               |                                                                |
| )                |                                       |                                                                                                                         |              | $\frown$                      |                                                                |
|                  | LINE SYMBOLS                          |                                                                                                                         |              | <b>88a</b>                    | Curtain Wall / Storefront Numb                                 |
|                  |                                       |                                                                                                                         |              |                               |                                                                |
|                  |                                       | – – CENTER LINE                                                                                                         |              | $\langle \mathbf{1t} \rangle$ | Window Number                                                  |
| ODE<br>DRATORIES |                                       | — — GRID LINE                                                                                                           |              | ~                             | Kourate David de                                               |
| RWISE            |                                       |                                                                                                                         |              |                               | Keynote Designation                                            |
|                  |                                       | PROPERTY LINE                                                                                                           |              | ^                             |                                                                |
|                  |                                       |                                                                                                                         |              | 88                            | Revision Delta                                                 |
|                  |                                       | CUT LINE                                                                                                                |              | I                             |                                                                |
|                  | v                                     |                                                                                                                         | N<br>Eleva   | ame                           | Vertical Elevation Datum                                       |
| G                |                                       |                                                                                                                         |              | Ν                             |                                                                |
|                  |                                       |                                                                                                                         |              |                               | North Arrow<br>Plan North                                      |
| ИВО              |                                       |                                                                                                                         |              | $\square$                     | <ul> <li>True North</li> </ul>                                 |
|                  |                                       |                                                                                                                         |              |                               |                                                                |
|                  |                                       |                                                                                                                         |              |                               | Graphic Scale                                                  |
| <u>}</u>         |                                       |                                                                                                                         |              | 16'                           |                                                                |
|                  |                                       | TES                                                                                                                     |              |                               |                                                                |
| RKING POINT      | GENERAL NO                            | JIEJ                                                                                                                    | _            |                               |                                                                |
|                  | 1. Design/build fire                  | sprinkler system and alarms to be installed per                                                                         |              |                               |                                                                |
|                  | requirements out<br>an extension of t | lined in code analysis at G-003. Both systems to be<br>ne (e) systems in the adjacent building                          |              |                               |                                                                |
|                  | 2. All dimensions to                  | f.o. stud, U.O.N.                                                                                                       |              |                               |                                                                |
|                  | 3. Refer to Addend prepared by Roo    | um #1, Option 3 in the Roofing Replacement Report<br>ftech Conultants Inc dated March 19, 2012 for<br>ations as needed. |              |                               |                                                                |
|                  | additional clarific                   | ations as needed.                                                                                                       |              |                               |                                                                |
|                  |                                       |                                                                                                                         |              |                               |                                                                |
|                  |                                       |                                                                                                                         |              |                               |                                                                |
| I                |                                       |                                                                                                                         | i i          |                               |                                                                |
|                  |                                       |                                                                                                                         |              |                               |                                                                |

## VICINITY MAP

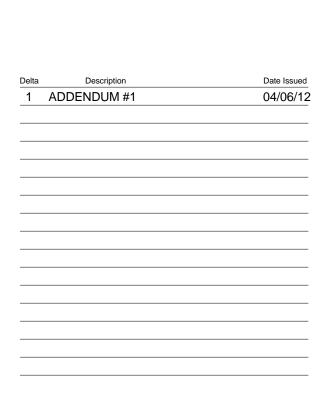


| BID ALTERNATE SUMMARY                                                                                                                                                        | INDEX OF DRAWINGS                                                                                           |             |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------|--|
| 1. INSTALL HEATING AND INSULATION AT EXISTING VEHICLE STORAGE<br>WALLS AND ROOFS, RE: DRAWINGS                                                                               | Sheet<br>No. Sheet Name                                                                                     | CD          |  |
| <ol> <li>INSTALL NEW EVIDENCE CAGE AND ALL REQUIRED MECHANICAL,<br/>PLUMBING, ELECTRICAL &amp; STRUCTURAL ITEMS AT EXISTING VEHICLE<br/>STORAGE. RE: DRAWINGS</li> </ol>     | GENERAL                                                                                                     |             |  |
| 3. INSTALL SKID-RESISTANT EPOXY FLOOR SEALER AT NEW GARAGE<br>INTERIOR; COLOR TO BE SELECTED BY ARCHITECT                                                                    | G-001 COVER SHEET<br>G-002 DRAWING INDEX, GENERAL NOTES, SYMBOLS, LEGENDS,<br>ABBREVIATIONS, VICINITY MAP   | X<br>X      |  |
| <ol> <li>INSTALL BUS DUCT; ELIMINATE DIRECT WIRE AND INSTALLATION OF<br/>400A PANEL; RE: ELEC</li> <li>PROVIDE 21" 'SOLATUBE' SKYLIGHTS; MODEL #750 DS-O OPEN CLG</li> </ol> | G-003 CODE PLAN / CODE INFORMATION                                                                          | X           |  |
| W/ LIGHT EXTERIOR INTERCEPTING TRANSFER DEVICE, EXTENSION<br>TUBE, & INTERIOR LENS; PROVIDE STEEL FRAMED OPENINGS AS<br>REQ'D; SEE PLAN FOR QTY.                             | CIVIL<br>C-100 COVER SHEET                                                                                  | x           |  |
| <ol> <li>PAINT ALL OVERHEAD STRUCTURE AND INTERIOR EXPOSED<br/>CONCRETE WALLS &amp; COLUMNS AT NEW GARAGE; COLOR TO BE<br/>SELECTED BY ARCHITECT</li> </ol>                  | C-101 DEMOLITION PLAN<br>C-102 HORIZONTAL CONTROL PLAN<br>C-103 GRADING & UTILITY PLAN                      | X<br>X<br>X |  |
| 7. INSTALL INTERIOR LOOPS FOR GARAGE DOORS; SEE 1/A-101 FOR<br>MORE INFO                                                                                                     | C-104 EROSION CONTROL PLAN<br>C-105 EROSION CONTROL DETAILS                                                 |             |  |
|                                                                                                                                                                              | C-106 OVERALL DRAINAGE PLAN                                                                                 | X           |  |
|                                                                                                                                                                              | ARCHITECTURAL SITE<br>AS-101 SITE PLANS                                                                     | x           |  |
|                                                                                                                                                                              | ARCHITECTURAL<br>A-101 FLOOR PLAN & PLAN DETAILS                                                            | x           |  |
|                                                                                                                                                                              | A-201REFLECTED CEILING PLANA-202ROOF PLAN & ROOF DETAILS                                                    | X<br>X      |  |
|                                                                                                                                                                              | A-301BUILDING ELEVATIONSA-401BUILDING SECTIONSA-402WALL SECTIONS                                            | X<br>X<br>X |  |
|                                                                                                                                                                              | STRUCTURAL                                                                                                  |             |  |
|                                                                                                                                                                              | S-001 GENERAL NOTES<br>S-101 FOUNDATION PLAN & DETAILS                                                      | X<br>X      |  |
|                                                                                                                                                                              | S-201 ROOF FRAMING PLAN & DETAILS<br>S-202 WALL FRAMING DETAILS & BRACE FRAME ELEVATIONS &<br>DETAILS       | X<br>X      |  |
|                                                                                                                                                                              | MECHANICAL                                                                                                  |             |  |
|                                                                                                                                                                              | M-001 MECHANICAL NOTES AND LEGEND<br>M-101 COMMAND VEHICLE STORAGE MECHANICAL PLAN                          | X X         |  |
|                                                                                                                                                                              | M-102 COMMAND VEHICLE STORAGE MECHANICAL ROOF<br>M-201 CONTROLS AND DETAILS<br>MEP-101 MECHANICAL SCHEDULES | X<br>X<br>X |  |
|                                                                                                                                                                              | PLUMBING                                                                                                    |             |  |
|                                                                                                                                                                              | P-100 COMMAND VEHICLE STORAGE UNDERGROUND PLUMBING<br>PLAN                                                  | X           |  |
|                                                                                                                                                                              | P-101 COMMAND VEHICLE STORAGE PLUMBING PLAN<br>ELECTRICAL                                                   | X           |  |
|                                                                                                                                                                              | E-100GENERAL NOTES AND LEGENDE-200ELECTRICAL SITE PLAN                                                      | X<br>X      |  |
|                                                                                                                                                                              | E-300 POWER & LIGHTING PLAN<br>E-400 ELECTRICAL PLAN GARAGE MODIFICATIONS<br>E-500 SCHEDULES                | X<br>X<br>X |  |
|                                                                                                                                                                              | E-500 SCHEDULES<br>SECURITY                                                                                 | X           |  |
|                                                                                                                                                                              | TS-201 SECURITY PLAN                                                                                        | x           |  |
|                                                                                                                                                                              |                                                                                                             |             |  |
|                                                                                                                                                                              |                                                                                                             |             |  |
|                                                                                                                                                                              |                                                                                                             |             |  |
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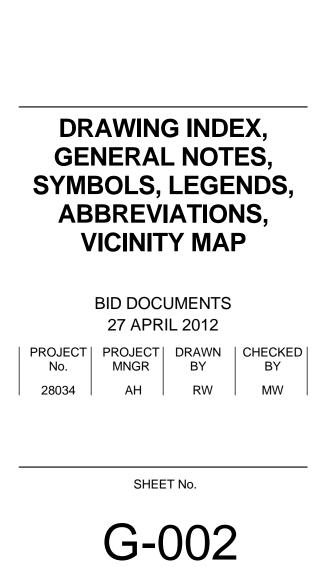


3501 Park Avenue

Denver, CO 80216







| PROJECT LOCATION                                                                                                                                                          |                                                                                                                  |  |  |  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|--|--|--|--|
| 3501 Park Avenue West<br>Denver, Colorado                                                                                                                                 |                                                                                                                  |  |  |  |  |
| HPA PROJECT NUMBE                                                                                                                                                         | <u>R</u>                                                                                                         |  |  |  |  |
| 28034                                                                                                                                                                     |                                                                                                                  |  |  |  |  |
| APPLICAELE CODES                                                                                                                                                          |                                                                                                                  |  |  |  |  |
| 2009 International Plumb<br>2009 International Mecha<br>2009 International Fuel G<br>2009 International Energy<br>2011 National Electric Co<br>2009 International Fire Co | Denver Amendments to 'l' Codes<br>ing Code<br>nical Code<br>ias Code<br>y Conservation Code<br>ide (NEC)         |  |  |  |  |
| NFPA STANDARDS                                                                                                                                                            | TITLE of PUBLICATION - DATE                                                                                      |  |  |  |  |
| NFPA 10<br>NFPA 13<br>NFPA 72                                                                                                                                             | Portable Fire Extinguisher – 2002<br>Installation of Sprinkler Systems – 2007<br>National Fire Alarm Code – 2007 |  |  |  |  |
| JURISDICTION                                                                                                                                                              |                                                                                                                  |  |  |  |  |
| Building Code Agency<br>Fire Department<br>Planning/Zoning<br>Water<br>Sanitary Sewer<br>Electric<br>Natural Gas<br>Telephone                                             |                                                                                                                  |  |  |  |  |

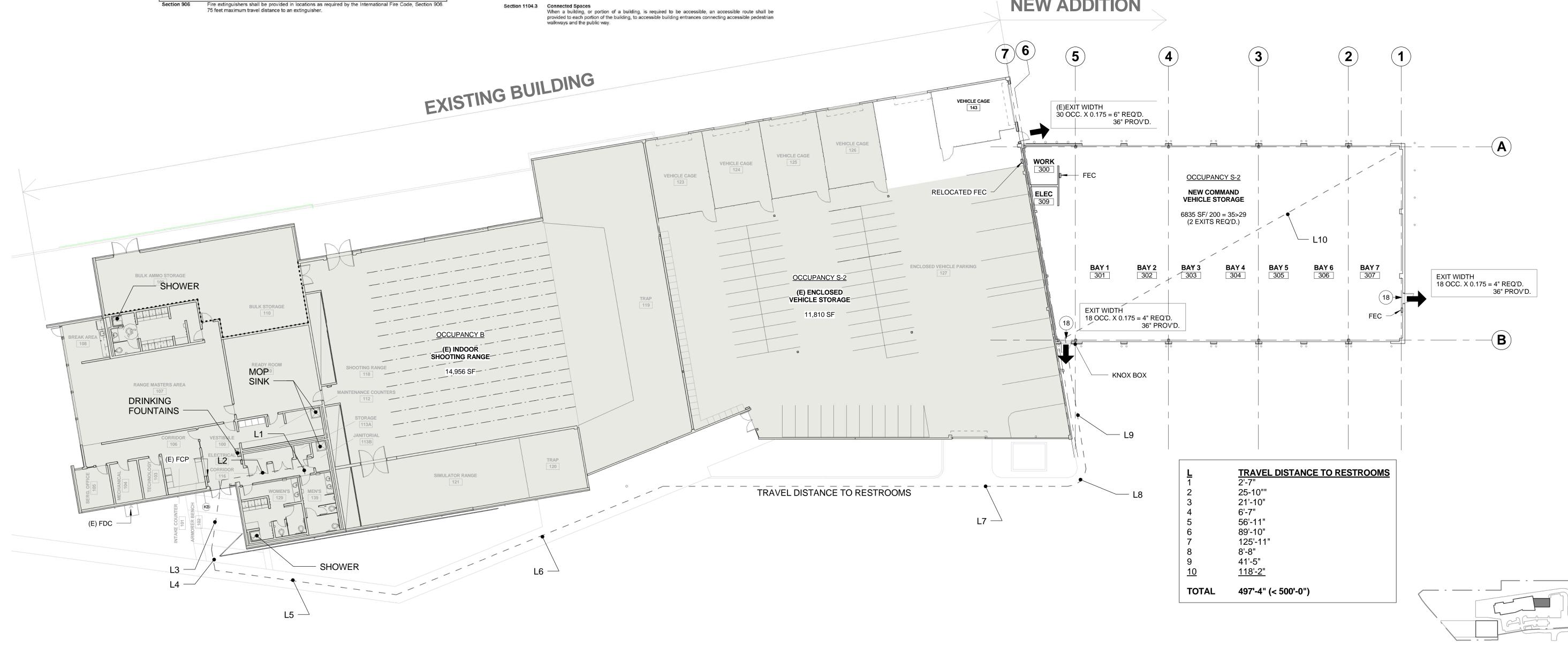
| City and County of Denver Building Department |
|-----------------------------------------------|
| City and County of Denver Fire Department     |
| Community Planning and Development Agency     |
| City and County of Denver                     |
| Denver Waste Water                            |
| Xcel                                          |
| Xcel                                          |

Qwest

| JSE AND OCCUPANC                                                                                                                                                                                                                                                                                                                   | Y CLA                          | SSIFICAT                                                                                                                                                                     | ION                                                                                   |                                                                                             |                                                                           | CH                                                                         | IAPTER 3                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------------------------|
| OCCUPANCY CLASSIFICA                                                                                                                                                                                                                                                                                                               |                                |                                                                                                                                                                              |                                                                                       |                                                                                             |                                                                           |                                                                            | Section 302                                                                |
| Occupancy/Classificatio                                                                                                                                                                                                                                                                                                            |                                |                                                                                                                                                                              | Floor Level                                                                           |                                                                                             | Δre                                                                       | a (Gross square                                                            |                                                                            |
| EXISTING INDOOR SHOOTIN                                                                                                                                                                                                                                                                                                            | G RANGE                        | -                                                                                                                                                                            | TIOOT LEVEL                                                                           |                                                                                             | Alc                                                                       |                                                                            | Teery                                                                      |
| Business                                                                                                                                                                                                                                                                                                                           | B                              | -                                                                                                                                                                            |                                                                                       |                                                                                             | 14,956                                                                    |                                                                            |                                                                            |
| EXISTING ENCLOSED PARKI                                                                                                                                                                                                                                                                                                            | ING GAR                        | AGE                                                                                                                                                                          |                                                                                       |                                                                                             |                                                                           |                                                                            |                                                                            |
| Enclosed Parking Garage                                                                                                                                                                                                                                                                                                            | S-2                            |                                                                                                                                                                              |                                                                                       |                                                                                             | 11,810                                                                    |                                                                            |                                                                            |
| NEW ENCLOSED PARKING                                                                                                                                                                                                                                                                                                               | GARAGE                         |                                                                                                                                                                              |                                                                                       |                                                                                             |                                                                           |                                                                            |                                                                            |
| _arge Vehicle Storage                                                                                                                                                                                                                                                                                                              | S-2                            |                                                                                                                                                                              |                                                                                       |                                                                                             | 6835                                                                      |                                                                            |                                                                            |
| Grand Total                                                                                                                                                                                                                                                                                                                        |                                |                                                                                                                                                                              |                                                                                       |                                                                                             | 33,601 GSF                                                                | 2                                                                          |                                                                            |
|                                                                                                                                                                                                                                                                                                                                    |                                |                                                                                                                                                                              |                                                                                       |                                                                                             |                                                                           |                                                                            |                                                                            |
| SPECIAL DETAILED R                                                                                                                                                                                                                                                                                                                 | REQUIR                         | EMENTS                                                                                                                                                                       | BASED O                                                                               |                                                                                             | D OCCUP                                                                   | ANCY CH                                                                    | APTER 4                                                                    |
|                                                                                                                                                                                                                                                                                                                                    |                                |                                                                                                                                                                              | DAGED OF                                                                              | 002741                                                                                      | 2 000017                                                                  |                                                                            |                                                                            |
| MOTOR-VEHICLE-RELATE                                                                                                                                                                                                                                                                                                               | D OCCL                         | <b>JPANCIES</b>                                                                                                                                                              |                                                                                       |                                                                                             |                                                                           |                                                                            | Section 404                                                                |
| Section 406.4 Enclosed                                                                                                                                                                                                                                                                                                             |                                |                                                                                                                                                                              |                                                                                       |                                                                                             |                                                                           |                                                                            |                                                                            |
| Section 406.4.2 Ventilation                                                                                                                                                                                                                                                                                                        |                                | alage                                                                                                                                                                        |                                                                                       |                                                                                             |                                                                           |                                                                            |                                                                            |
| A mechani                                                                                                                                                                                                                                                                                                                          | cal ventila                    | tion system sl                                                                                                                                                               | hall be provide                                                                       | d in accordance                                                                             | e with the Inte                                                           | rnational Mecha                                                            | anical Code.                                                               |
|                                                                                                                                                                                                                                                                                                                                    |                                |                                                                                                                                                                              |                                                                                       |                                                                                             |                                                                           |                                                                            |                                                                            |
| CONCEPTION OF A COL                                                                                                                                                                                                                                                                                                                | I O A TION                     |                                                                                                                                                                              |                                                                                       |                                                                                             |                                                                           |                                                                            |                                                                            |
|                                                                                                                                                                                                                                                                                                                                    | -ICATION                       |                                                                                                                                                                              |                                                                                       |                                                                                             |                                                                           |                                                                            |                                                                            |
| Occupancy                                                                                                                                                                                                                                                                                                                          |                                | Occu                                                                                                                                                                         | pancy Classifi                                                                        | cation                                                                                      |                                                                           | m Constructio                                                              |                                                                            |
| Occupancy<br>Existing Indoor Shooting Range                                                                                                                                                                                                                                                                                        | 9                              | Occup<br>B                                                                                                                                                                   | pancy Classifi                                                                        | cation                                                                                      |                                                                           | Im Construction                                                            |                                                                            |
| Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Gara                                                                                                                                                                                                                                                      | e<br>age                       | Occup<br>B<br>S-2                                                                                                                                                            |                                                                                       |                                                                                             | Type IIB - Fu                                                             | lly sprinklered (                                                          | (NFPA 13)                                                                  |
| Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Gara                                                                                                                                                                                                                                                      | e<br>age                       | Occup<br>B<br>S-2                                                                                                                                                            | pancy Classifi<br>B Governs the                                                       |                                                                                             | Type IIB - Fu                                                             |                                                                            | (NFPA 13)                                                                  |
| Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Gara<br>New Enclosed Parking Garage                                                                                                                                                                                                                       | e<br>age                       | Occuj<br>B<br>S-2<br>S-2 (Existing                                                                                                                                           | B Governs the                                                                         |                                                                                             | Type IIB - Fu                                                             | lly sprinklered (<br>lly sprinklered (                                     | (NFPA 13)<br>(NFPA 13)                                                     |
| Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Gara<br>New Enclosed Parking Garage                                                                                                                                                                                                                       | e<br>age                       | Occuj<br>B<br>S-2<br>S-2 (Existing                                                                                                                                           | B Governs the                                                                         |                                                                                             | Type IIB - Fu                                                             | lly sprinklered (<br>lly sprinklered (                                     | (NFPA 13)                                                                  |
| Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Gara<br>New Enclosed Parking Garage<br>GENERAL BUILDING                                                                                                                                                                                                   | e<br>age<br>HEIGH <sup>-</sup> | Occuj<br>B<br>S-2<br>S-2 (Existing                                                                                                                                           | B Governs the                                                                         |                                                                                             | Type IIB - Fu                                                             | lly sprinklered (<br>Ily sprinklered (<br>CH                               | (NFPA 13)<br>(NFPA 13)                                                     |
| Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Gara<br>New Enclosed Parking Garage<br>GENERAL BUILDING                                                                                                                                                                                                   | e<br>age<br>HEIGH <sup>-</sup> | Occuj<br>B<br>S-2<br>S-2 (Existing                                                                                                                                           | B Governs the                                                                         |                                                                                             | Type IIB - Fu                                                             | lly sprinklered (<br>Ily sprinklered (<br>CH                               | (NFPA 13)<br>(NFPA 13)                                                     |
| Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Gara<br>New Enclosed Parking Garage<br>GENERAL BUILDING<br>GENERAL HEIGHT AND A                                                                                                                                                                           | e<br>age<br>HEIGH <sup>-</sup> | Occuj<br>B<br>S-2<br>S-2 (Existing                                                                                                                                           | B Governs the                                                                         |                                                                                             | Type IIB - Fu                                                             | lly sprinklered (<br>Ily sprinklered (<br>CH                               | (NFPA 13)<br>(NFPA 13)<br>IAPTER 5<br>Section 503                          |
| CONSTRUCTION CLASSIF<br>Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Gara<br>New Enclosed Parking Garage<br>GENERAL BUILDING<br>GENERAL HEIGHT AND A<br>HEIGHT                                                                                                                                         | e<br>age<br>HEIGH <sup>-</sup> | Occuj<br>B<br>S-2<br>S-2 (Existing                                                                                                                                           | B Governs the                                                                         |                                                                                             | Type IIB - Fu                                                             | lly sprinklered (<br>Ily sprinklered (<br>CH                               | (NFPA 13)<br>(NFPA 13)                                                     |
| Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Gara<br>New Enclosed Parking Garage<br>GENERAL BUILDING<br>GENERAL HEIGHT AND A<br>HEIGHT                                                                                                                                                                 | e<br>age<br>HEIGH              | Occuj<br>B<br>S-2<br>S-2 (Existing<br>TS AND A                                                                                                                               | B Governs the                                                                         |                                                                                             | Type IIB - Fu                                                             | Ily sprinklered (<br>Ily sprinklered (<br>CH                               | (NFPA 13)<br>IAPTER 5<br>Section 503<br>Section 504                        |
| Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Garage<br>New Enclosed Parking Garage<br>GENERAL BUILDING<br>GENERAL HEIGHT AND A<br>HEIGHT<br>ALLOWABLE BUILDING H                                                                                                                                       | e<br>age<br>HEIGH              | Occup<br>B<br>S-2<br>S-2 (Existing<br>TS AND A<br>IITATIONS                                                                                                                  | REAS                                                                                  | Design)                                                                                     | Type IIB - Fu                                                             | Ily sprinklered (<br>Ily sprinklered (<br>CH                               | (NFPA 13)<br>IAPTER 5<br>Section 503<br>Section 504<br>Section 504         |
| Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Garage<br>New Enclosed Parking Garage<br>GENERAL BUILDING<br>GENERAL HEIGHT AND A<br>HEIGHT<br>ALLOWABLE BUILDING H<br>Height and Stories                                                                                                                 | e<br>age<br>HEIGH              | Occuj<br>B<br>S-2<br>S-2 (Existing<br>TS AND A<br>IITATIONS<br>Above Grad<br>Existing B                                                                                      | REAS                                                                                  | Design)                                                                                     | Type IIB - Fu<br>Type IIB - Fu<br>Occupancy                               | Ily sprinklered (<br>Ily sprinklered (<br>CH                               | (NFPA 13)<br>IAPTER 5<br>Section 503<br>Section 504                        |
| Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Garage<br>New Enclosed Parking Garage<br>GENERAL BUILDING<br>GENERAL HEIGHT AND A<br>HEIGHT<br>ALLOWABLE BUILDING H                                                                                                                                       | e<br>age<br>HEIGH              | Occuj<br>B<br>S-2<br>S-2 (Existing<br>TS AND A<br>IITATIONS<br>Above Grad<br>Existing B<br>(Most re                                                                          | REAS                                                                                  | Design)<br>New S-2 (B Governs                                                               | Type IIB - Fu<br>Type IIB - Fu<br>Occupancy<br>s the Design)              | Ily sprinklered (<br>Ily sprinklered (<br>CH                               | (NFPA 13)<br>IAPTER 5<br>Section 503<br>Section 504<br>Section 504         |
| Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Garage<br>New Enclosed Parking Garage<br>GENERAL BUILDING<br>GENERAL HEIGHT AND A<br>HEIGHT<br>ALLOWABLE BUILDING H<br>Height and Stories                                                                                                                 | e<br>age<br>HEIGH              | Occuj<br>B<br>S-2<br>S-2 (Existing<br>TS AND A<br>IITATIONS<br>Above Grad<br>Existing B<br>(Most re<br>IIB con                                                               | B Governs the<br>REAS<br>le Plane)<br>Occupancy<br>estrictive)<br>struction           | Design)<br>New S-2<br>(B Governs                                                            | Type IIB - Fu<br>Type IIB - Fu<br>Occupancy<br>s the Design)<br>struction | Ily sprinklered (<br>Ily sprinklered (<br>CH<br>S<br>Table 503, 4<br>Not I | (NFPA 13)<br>IAPTER 5<br>Section 503<br>Section 504<br>Section 504<br>Jsed |
| Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Garage<br>New Enclosed Parking Garage<br>GENERAL BUILDING<br>GENERAL HEIGHT AND A<br>HEIGHT<br>ALLOWABLE BUILDING H<br>Height and Stories<br>(Above Grade Plane)                                                                                          | e<br>age<br>HEIGH              | Occuj<br>B<br>S-2<br>S-2 (Existing<br>TS AND A<br>IITATIONS<br>Above Grad<br>Existing B<br>(Most re                                                                          | REAS                                                                                  | Design)<br>New S-2 (B Governs                                                               | Type IIB - Fu<br>Type IIB - Fu<br>Occupancy<br>s the Design)              | Ily sprinklered (<br>Ily sprinklered (<br>CH                               | (NFPA 13)<br>IAPTER 5<br>Section 503<br>Section 504<br>Section 504         |
| Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Garage<br>New Enclosed Parking Garage<br>GENERAL BUILDING<br>GENERAL HEIGHT AND A<br>HEIGHT<br>ALLOWABLE BUILDING H<br>Height and Stories<br>(Above Grade Plane)                                                                                          | e<br>age<br>HEIGH              | Occuj<br>B<br>S-2<br>S-2 (Existing<br>TS AND A<br>IITATIONS<br>Above Grad<br>Existing B<br>(Most re<br>IIB con:<br>Allowable                                                 | REAS                                                                                  | Design)<br>New S-2<br>(B Governs<br>IIB con<br>Allowable                                    | Type IIB - Fu<br>Type IIB - Fu<br>Occupancy<br>s the Design)<br>struction | Ily sprinklered (<br>Ily sprinklered (<br>CH<br>S<br>Table 503, 4<br>Not I | (NFPA 13)<br>IAPTER 5<br>Section 503<br>Section 504<br>Section 504<br>Jsed |
| Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Garage<br>New Enclosed Parking Garage<br>GENERAL BUILDING<br>GENERAL HEIGHT AND A<br>HEIGHT<br>ALLOWABLE BUILDING H<br>Height and Stories<br>(Above Grade Plane)<br>STORIES<br>Allowable Stories                                                          | e<br>age<br>HEIGH              | Occup<br>B<br>S-2<br>S-2 (Existing<br>TS AND A<br>IITATIONS<br>Above Grad<br>Existing B<br>(Most re<br>IIB con:<br>Allowable<br>4 story                                      | REAS                                                                                  | Design)<br>New S-2<br>(B Governs<br>IIE con<br>Allowable<br>4 story                         | Type IIB - Fu<br>Type IIB - Fu<br>Occupancy<br>s the Design)<br>struction | Ily sprinklered (<br>Ily sprinklered (<br>CH<br>S<br>Table 503, 4<br>Not I | (NFPA 13)<br>IAPTER 5<br>Section 503<br>Section 504<br>Section 504<br>Jsed |
| Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Garage<br>New Enclosed Parking Garage<br>GENERAL BUILDING<br>GENERAL HEIGHT AND A<br>HEIGHT<br>ALLOWABLE BUILDING H<br>Height and Stories<br>(Above Grade Plane)<br>STORIES<br>Allowable Stories<br>Sprinkler Increase                                    | e<br>age<br>HEIGH              | Occup<br>B<br>S-2<br>S-2 (Existing<br>TS AND A<br>IITATIONS<br>IITATIONS<br>Above Grad<br>Existing B<br>(Most re<br>IIB con:<br>Allowable<br>4 story<br>Not taken            | B Governs the<br>REAS<br>le Plane)<br>Occupancy<br>estrictive)<br>struction<br>Actual | New S-2<br>(B Governa<br>IIE con<br>Allowable                                               | Dccupancy<br>s the Design)<br>struction<br>Actual                         | Ily sprinklered (<br>Ily sprinklered (<br>CH<br>S<br>Table 503, 4<br>Not I | (NFPA 13)<br>IAPTER 5<br>Section 503<br>Section 504<br>Section 504<br>Jsed |
| Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Garage<br>New Enclosed Parking Garage<br>GENERAL BUILDING<br>GENERAL HEIGHT AND A<br>HEIGHT<br>ALLOWABLE BUILDING H<br>Height and Stories<br>(Above Grade Plane)<br>STORIES<br>Allowable Stories<br>Sprinkler Increase<br>Fotal Allowable Stories         | e<br>age<br>HEIGH              | Occup<br>B<br>S-2<br>S-2 (Existing<br>TS AND A<br>IITATIONS<br>Above Grad<br>Existing B<br>(Most re<br>IIB con:<br>Allowable<br>4 story                                      | REAS                                                                                  | Design)<br>New S-2<br>(B Governs<br>IIE con<br>Allowable<br>4 story                         | Type IIB - Fu<br>Type IIB - Fu<br>Occupancy<br>s the Design)<br>struction | Ily sprinklered (<br>Ily sprinklered (<br>CH<br>S<br>Table 503, 4<br>Not I | (NFPA 13)<br>IAPTER 5<br>Section 503<br>Section 504<br>Section 504<br>Jsed |
| Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Garage<br>New Enclosed Parking Garage<br>GENERAL BUILDING<br>GENERAL HEIGHT AND A<br>HEIGHT<br>ALLOWABLE BUILDING H<br>Height and Stories<br>(Above Grade Plane)<br>STORIES<br>Movable Stories<br>Sprinkler Increase<br>Total Allowable Stories<br>HEIGHT | e<br>age<br>HEIGH              | Occuj<br>B<br>S-2<br>S-2 (Existing<br>TS AND A<br>IITATIONS<br>IITATIONS<br>Above Grad<br>Existing B<br>(Most re<br>IIB con:<br>Allowable<br>4 story<br>Not taken<br>4 story | B Governs the<br>REAS<br>le Plane)<br>Occupancy<br>estrictive)<br>struction<br>Actual | Design)<br>New S-2<br>(B Governs<br>IIB con<br>Allowable<br>4 story<br>Not taken<br>4 story | Dccupancy<br>s the Design)<br>struction<br>Actual                         | Ily sprinklered (<br>Ily sprinklered (<br>CH<br>S<br>Table 503, 4<br>Not I | (NFPA 13)<br>IAPTER 5<br>Section 503<br>Section 504<br>Section 504<br>Jsed |
| Occupancy<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Garage<br>New Enclosed Parking Garage<br>GENERAL BUILDING<br>GENERAL HEIGHT AND A<br>HEIGHT<br>ALLOWABLE BUILDING H<br>Height and Stories                                                                                                                 | e<br>age<br>HEIGH              | Occup<br>B<br>S-2<br>S-2 (Existing<br>TS AND A<br>IITATIONS<br>IITATIONS<br>Above Grad<br>Existing B<br>(Most re<br>IIB con:<br>Allowable<br>4 story<br>Not taken            | B Governs the<br>REAS<br>le Plane)<br>Occupancy<br>estrictive)<br>struction<br>Actual | New S-2<br>(B Governa<br>IIE con<br>Allowable<br>4 story<br>Not taken                       | Dccupancy<br>s the Design)<br>struction<br>Actual                         | Ily sprinklered (<br>Ily sprinklered (<br>CH<br>S<br>Table 503, 4<br>Not I | (NFPA 13)<br>IAPTER 5<br>Section 503<br>Section 504<br>Section 504<br>Jsed |

| Area Limitations         Existing B Occ<br>(Most restric<br>IIB construct<br>Section 506.3           Basic allowable floor area per story<br>(Table 505)         23000           Frontage increase (If)<br>(See area modifications below)         Not taken           Allowable increase for sprinkler (Is)<br>(See section 506.3 below)         23000x(3)=69000           Total allowable area per story (Aa)<br>(See area modifications below)         23000+69000=92           Maximum area (Aa x No. of stories)<br>(See area modifications below)         N/A           Total allowable area per story<br>(See area for sprinkler year)         92,000 >33,601           (See forthose)         Footnote:         Existing building with Occupancy B are<br>Occupancy B being the most restricti<br>nonseparated mixed use occupancy<br>governs the design for being the most restricti<br>nonseparated mixed use occupancy<br>governs the design for being the most restricti<br>nonseparated mixed use occupancy           North Wall         239'-3"           East Wall         170'-11"           South Wall         N/A           West Wall         139'-6"           AREA MODIFICATIONS         OCCUPANCY           Aa = At + [At x If] + [At x Is]           Section 506.3         Automatic Sprinkler System Increass<br>Where a building is equipped througho<br>Section 903.3.1.1 (NFPA 13), the area<br>300 percent (Is=3) for buildings with no           MIXED USE AND OCCUPANCY         Nonseparated Occupancies shall be in<br>Code requirements shall apply to eac<br>that space except                                                                                                                                                                                                                                                                                                                                                                                                                     | ALLOWABLE B                                   | UILDING AREAS (S                                                                     | Square Feet)                                                                                  |                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------|
| (Most restrict<br>IIB construct<br>IIB construct<br>(Table 505)           Frontage increase (if)<br>(See area modifications below)         Not taken           Allowable increase for sprinkler (is)<br>(See Section 506.3 below)         23000x(3)=69000           Total allowable area per story (Aa)<br>(See Section 506.3 below)         23000+69000=92           Maximum area (Aa x No. of stories)<br>(See Section 506.4.1 below)         23000+69000=92           Maximum area (Aa x No. of stories)<br>(See Section 506.4.1 below)         92,000 >33,601           Total allowable area per story<br>(See footnote)         92,000 >33,601           Footnote:         Existing building with Occupancy B ar<br>Occupancy B being the most restrictin<br>nonseparated mixed use occupancy<br>governs the design for being the most restrictin<br>nonseparated mixed use occupancy<br>governs the design for being the most restrictin<br>North Wall           North Wall         239'-3"           East Wall         170'-11"           South Wall         N/A           West Wall         139'-6"           AREA MODIFICATIONS           OCCUPANCY           Aa = At + [At x If] + [At x Is]           Section 506.3         Automatic Sprinkler System Increass<br>Where a building is equipped through<br>Section 903.3.1.1 (NFPA 13), the area<br>300 percent (Is=3) for buildings with no<br>Section 508.3.2           Nonseparated occupancies shall be in<br>Code requirements shall apply to eac<br>that space except that the most rest<br>building. The allowable area and heir<br>required betwe                                                                                                                                                                                                                                                                                                                                                                                                              |                                               |                                                                                      | Existing B Occu                                                                               |                  |
| Basic allowable floor area per story<br>(Table 505)       23000         Frontage increase (If)<br>(See area modifications below)       Not taken         Allowable increase for sprinkler (Is)<br>(See Section 506.3 below)       23000+69000=92<br>(See section 506.4.1 below)         Total allowable area per story<br>(See Section 506.4.1 below)       N/A         Total allowable area per story<br>(See Section 506.4.1 below)       92,000 >33,601<br>(See footnote)         Footnote:       Existing building with Occupancy B ar<br>Occupancy B being the most restricti<br>nonseparated mixed use occupancy<br>governs the design for being the most restricti<br>nonseparated mixed use occupancy<br>governs the design for being the most restricti<br>nonseparated mixed use occupancy<br>governs the design for being the most restriction<br>nonseparated mixed use occupancy<br>governs the design for being the most restriction<br>nonseparated mixed use occupancy<br>governs the design for being the most restriction<br>nonseparated mixed use occupancy<br>governs the design for being the most restriction<br>nonseparated mixed use occupancy<br>governs the design for being the most restriction<br>nonseparated mixed use occupancy<br>governs the design for being the most restriction<br>North Wall         North Wall       239-3°         East Wall       139-6°         AREA MODIFICATIONS         OCCUPANCY         Aa = At + [At x If] + [At x Is]         Section 506.3       Automatic Sprinkler System Increass<br>Where a building is equipped througho<br>Section 903 3.1.1 (NFPA 13), the area<br>300 percent (Is=3) for buildings with no         MIXED USE AND OCCUPANCIES (Between Exist<br>Section 508.3.2       Non                                                                                                                                                                                                                                                              |                                               |                                                                                      | (Most restrictiv                                                                              |                  |
| (Table 505)       Not taken         Frontage increase (If)       Not taken         (See area modifications below)       23000x(3)=69000         Allowable increase for sprinkler (Is)       23000x(3)=69000         (See section 506.3 below)       23000x(3)=69000         Total allowable area per story (Aa)       23000x(3)=69000         (See section 506.3 below)       N/A         (See section 506.4.1 below)       YA         Total allowable area per story       92,000 >33,601         (See footnote)       See footnote)         Footnote:       Existing building with Occupancy B ar         Occupancy B being the most restrictinonseparated mixed use occupancy       governs the design for being the most restrictinon Distance (Feet         North Wall       239-3°         East Wall       170-11°         South Wall       N/A         West Wall       139-6°         AREA MODIFICATIONS       Occupancy         OCCUPANCY       Aa = At + [At x If] + [At x Is]         Aa = At + [At x If] + [At x Is]       Nonseparated occupancies shall be in Code requirements shall apply to eac that space except that the most rest building. The allowable area and heig required between occupancies shall be in Code requirements shall apply to eac that space except that the most rest building. The allowable area and heig required between occupancies pre Sec <td colsp<="" th=""><th></th><th></th><th>IIB construction</th></td>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <th></th> <th></th> <th>IIB construction</th> |                                                                                      |                                                                                               | IIB construction |
| (See area modifications below)       Allowable increase for sprinkler (is)       23000x(3)=69000         (See Section 506.3 below)       23000+69000=92         Total allowable area per story       (A)       23000+69000=92         (See area modifications below)       N/A       1000000000000000000000000000000000000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                               | or area per story                                                                    | 23000                                                                                         |                  |
| Allowable increase for sprinkler (Is)<br>(See Section 506.3 below)       23000x(3)=69000         Total allowable area per story (Aa)<br>(See area modifications below)       23000+69000=92         Maximum area (Aa x No. of stories)<br>(See Section 506.4.1 below)       N/A         Total allowable area per story       92,000 >33,601<br>(See footnote)         Footnote:       Existing building with Occupancy B ar<br>Occupancy B being the most restricti<br>nonseparated mixed use occupancy<br>governs the design for being the most restricti<br>nonseparated mixed use occupancy         North Wall       239'-3"         East Wall       170'-11"         South Wall       N/A         West Wall       139'-6"         AREA MODIFICATIONS         OCCUPANCY         Aa = At + [At x If] + [At x Is]         Section 506.3       Automatic Sprinkler System Increase<br>Where a building is equipped througho<br>Section 903.3.1.1 (NFPA 13), the area<br>300 percent (Is=3) for buildings with no         MIXED USE AND OCCUPANCIES (Between Exist<br>Section 508.3.2       Nonseparated occupancies<br>Nonseparated occupancies shall be in<br>Code requirements shall apply to eac<br>that space except that the most rest<br>building. The allowable area and heig<br>required between occupancies per Sec         TYPES OF CONSTRUCTION       Occupancy         Construction CLASSIFICATION<br>Existing Indoor Shooting Range       B<br>Existing Enclosed Parking Garage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                               |                                                                                      | Not taken                                                                                     |                  |
| Total allowable area per story (Aa)<br>(See area modifications below)       23000+69000=92         Maximum area (Aa x No. of stories)<br>(See Section 506.4.1 below)       N/A         Total allowable area per story       92,000 >33,601<br>(See footnote)         Footnote:       Existing building with Occupancy B ar<br>Occupancy B being the most restrict<br>nonseparated mixed use occupancy I<br>governs the design for being the most restrict<br>nonseparated mixed use occupancy I<br>governs the design for being the most restrict<br>nonseparated mixed use occupancy I<br>ast Wall         North Wall       239-3"         East Wall       170-11"         South Wall       N/A         West Wall       139'-6"         AREA MODIFICATIONS         OCCUPANCY         Aa = At + [At x If] + [At x Is]         Section 506.3       Automatic Sprinkler System Increass<br>Where a building is equipped througho<br>Section 903.3.1.1 (NFPA 13), the area<br>300 percent (Is=3) for buildings with no         MIXED USE AND OCCUPANCY       Nonseparated occupancies<br>Nonseparated occupancies shall be in<br>Code requirements shall apply to eac<br>that space except that the most rest<br>building. The allowable area and hei<br>required between occupancies per Sec         TYPES OF CONSTRUCTION       Occupancy         Construction CLASSIFICATION<br>Existing Indoor Shooting Range<br>Existing Enclosed Parking Garage       B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Allowable increase                            | for sprinkler (Is)                                                                   | 23000x(3)=69000                                                                               |                  |
| Maximum area (Aa x No. of stories)<br>(See Section 506.4.1 below)       N/A         Total allowable area per story       92,000 >33,601<br>(See footnote)         Footnote:       Existing building with Occupancy B ar<br>Occupancy B being the most restrictinonseparated mixed use occupancy<br>governs the design for being the most restrictinon pistance (Feetu<br>North Wall         PIRE SEPARATION (Location on Property)         Orientation       Distance (Feetu<br>North Wall         South Wall       170'-11"         South Wall       N/A         West Wall       139'-6"         AREA MODIFICATIONS         OCCUPANCY         Aa = At + [At x If] + [At x Is]         Section 506.3       Automatic Sprinkler System Increases<br>Where a building is equipped througho<br>Section 903.3.1.1 (NFPA 13), the area<br>300 percent (Is=3) for buildings with no         MIXED USE AND OCCUPANCY         Nonseparated occupancies shall be in<br>Code requirements shall apply to eac<br>that space except that the most restribuilding. The allowable area and heig<br>required between occupancies per Sec         TYPES OF CONSTRUCTION         Construction CLASSIFICATION<br>Existing Indoor Shooting Range       B         Existing Enclosed Parking Garage       S-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Total allowable are                           | a per story (Aa)                                                                     | 23000+69000=9200                                                                              |                  |
| Total allowable area per story       92,000 >33,601<br>(See footnote)         Footnote:       Existing building with Occupancy B ar<br>Occupancy B being the most restrictin<br>nonseparated mixed use occupancy<br>governs the design for being the most of<br>Distance (Feet<br>North Wall         PIRE SEPARATION (Location on Property)       Orientation         Orientation       Distance (Feet<br>North Wall         South Wall       239-3"         East Wall       170-11"         South Wall       N/A         West Wall       139'-6"         AREA MODIFICATIONS       OCCUPANCY         Aa = At + [At x If] + [At x Is]       Section 506.3         Automatic Sprinkler System Increass<br>Where a building is equipped througho<br>Section 903.3.1.1 (NFPA 13), the area<br>300 percent (is=3) for buildings with no         MIXED USE AND OCCUPANCY       Nonseparated Occupancies<br>Nonseparated Occupancies shall be in<br>Code requirements shall apply to eac<br>that space except that the most restribuilding. The allowable area and heig<br>required between occupancies per Sec         TYPES OF CONSTRUCTION       Occupancy         Occupancy       Occupance<br>Section Shooting Range         Existing Indoor Shooting Range       B         Existing Enclosed Parking Garage       S-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Maximum area (Aa                              | x No. of stories)                                                                    | N/A                                                                                           |                  |
| Footnote:       Existing building with Occupancy B arr<br>Occupancy B being the most restrictinonseparated mixed use occupancy<br>governs the design for being the most restrictinon         FIRE SEPARATION (Location on Property)         Orientation       Distance (Feet<br>Distance (Feet<br>North Wall         North Wall       239-3"         East Wall       170'-11"         South Wall       N/A         West Wall       139-6"         AREA MODIFICATIONS       OCCUPANCY         Aa = At + [At x If] + [At x Is]       Automatic Sprinkler System Increases<br>Where a building is equipped througho<br>Section 903.3.1.1 (NFPA 13), the area<br>300 percent (Is=3) for buildings with no         MIXED USE AND OCCUPANCY       Nonseparated Occupancies<br>Nonseparated occupancies shall be in<br>Code requirements shall apply to eac<br>that space except that the most restribuilding. The allowable area and heig<br>required between occupancies per Sec         TYPES OF CONSTRUCTION       Occupancy<br>Docupancy       Occupance<br>Docupancy         CONSTRUCTION CLASSIFICATION<br>Existing Indoor Shooting Range       B<br>Existing Enclosed Parking Garage       S-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                               |                                                                                      |                                                                                               |                  |
| Orientation         Distance (Feetule           North Wall         239-3"           East Wall         170'-11"           South Wall         N/A           West Wall         139'-6"           AREA MODIFICATIONS         AREA MODIFICATIONS           OCCUPANCY         Aa = At + [At x If] + [At x Is]           Section 506.3         Automatic Sprinkler System Increases<br>Where a building is equipped throughon<br>Section 903.3.1.1 (NFPA 13), the area<br>300 percent (Is=3) for buildings with no           MIXED USE AND OCCUPANCY         Nonseparated Occupancies<br>Nonseparated occupancies shall apply to eac<br>that space except that the most rest<br>building. The allowable area and heig<br>required between occupancies per Sec           TYPES OF CONSTRUCTION         Construction CLASSIFICATION           Occupancy         Occupance<br>Section Shooting Range           Existing Enclosed Parking Garage         S-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                               | Occupancy B being<br>nonseparated mixed<br>governs the design f                      | h Occupancy B and<br>the most restrictive<br>d use occupancy w<br>for being the most res      |                  |
| North Wall       239'-3"         East Wall       170'-11"         South Wall       N/A         West Wall       N/A         West Wall       139'-6"         AREA MODIFICATIONS       OCCUPANCY         Aa = At + [At x If] + [At x Is]       Section 506.3         Section 506.3       Automatic Sprinkler System Increases         Where a building is equipped throughon       Section 903.3.1.1 (NFPA 13), the area         300 percent (Is=3) for buildings with no       MIXED USE AND OCCUPANCY         NONSEPARATED OCCUPANCIES (Between Existing       Section 508.3.2         Nonseparated occupancies       Nonseparated occupancies         Nonseparated occupancies shall be in       Code requirements shall apply to eact         that space except that the most restribuilding. The allowable area and heig       required between occupancies per Sect         TYPES OF CONSTRUCTION       Construction CLASSIFICATION         Occupancy       Occupance         Existing Indoor Shooting Range       B         Existing Enclosed Parking Garage       S-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                               |                                                                                      |                                                                                               |                  |
| East Wall       170'-11"         South Wall       N/A         West Wall       139'-6"         AREA MODIFICATIONS       Area Modifications         OCCUPANCY       Aa = At + [At x If] + [At x Is]         Section 506.3       Automatic Sprinkler System Increases         Where a building is equipped throughon       Section 903.3.1.1 (NFPA 13), the area         300 percent (Is=3) for buildings with no       MIXED USE AND OCCUPANCY         NONSEPARATED OCCUPANCIES (Between Exist)       Section 508.3.2         Nonseparated Occupancies       Nonseparated Occupancies shall be in<br>Code requirements shall apply to eac<br>that space except that the most restr<br>building. The allowable area and heig<br>required between occupancies per Sec         TYPES OF CONSTRUCTION       CONSTRUCTION CLASSIFICATION         Occupancy       Occupance         Existing Indoor Shooting Range       B         Existing Enclosed Parking Garage       S-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                               | itation                                                                              |                                                                                               |                  |
| South Wall       N/A         West Wall       139'-6"         AREA MODIFICATIONS       OCCUPANCY         Aa = At + [At x If] + [At x Is]       Aa = At + [At x If] + [At x Is]         Section 506.3       Automatic Sprinkler System Increases         Where a building is equipped throughon       Section 903.3.1.1 (NFPA 13), the area         300 percent (Is=3) for buildings with no       MIXED USE AND OCCUPANCIES (Between Exist)         Section 508.3.2       Nonseparated Occupancies shall be in Code requirements shall apply to eact that space except that the most restructions. The allowable area and heig required between occupancies per Section 508.12.         TYPES OF CONSTRUCTION       CONSTRUCTION CLASSIFICATION         Occupancy       Occupance         Existing Indoor Shooting Range       B         Existing Enclosed Parking Garage       S-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                               |                                                                                      |                                                                                               |                  |
| West Wall       139'-6"         AREA MODIFICATIONS         OCCUPANCY         Aa = At + [At x If] + [At x Is]         Section 506.3       Automatic Sprinkler System Increases<br>Where a building is equipped throughon<br>Section 903.3.1.1 (NFPA 13), the area<br>300 percent (is=3) for buildings with no         MIXED USE AND OCCUPANCIES (Between Existing<br>Section 508.3.2       Nonseparated Occupancies<br>Nonseparated Occupancies shall be in<br>Code requirements shall apply to eact<br>that space except that the most rests<br>building. The allowable area and heigh<br>required between occupancies per Sect         TYPES OF CONSTRUCTION         CONSTRUCTION CLASSIFICATION         Occupancy       Occupance<br>B<br>Existing Indoor Shooting Range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                               |                                                                                      |                                                                                               |                  |
| AREA MODIFICATIONS         OCCUPANCY         Aa = At + [At x If] + [At x Is]         Section 506.3       Automatic Sprinkler System Increases<br>Where a building is equipped throughon<br>Section 903.3.1.1 (NFPA 13), the area<br>300 percent (Is=3) for buildings with not         MIXED USE AND OCCUPANCIES (Between Existing<br>Section 508.3.2       Nonseparated Occupancies<br>Nonseparated occupancies shall be in<br>Code requirements shall apply to eact<br>that space except that the most rests<br>building. The allowable area and heig<br>required between occupancies per Sect         TYPES OF CONSTRUCTION         CONSTRUCTION CLASSIFICATION         Occupancy       Occupance<br>B<br>Existing Indoor Shooting Range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                               |                                                                                      |                                                                                               |                  |
| OCCUPANCY         Aa = At + [At x If] + [At x Is]         Section 506.3       Automatic Sprinkler System Increases<br>Where a building is equipped throughon<br>Section 903.3.1.1 (NFPA 13), the area<br>300 percent (Is=3) for buildings with no         MIXED USE AND OCCUPANCY         NONSEPARATED OCCUPANCIES (Between Exist)<br>Section 508.3.2         Nonseparated Occupancies<br>Nonseparated occupancies shall be in<br>Code requirements shall apply to eac<br>that space except that the most rest<br>building. The allowable area and heig<br>required between occupancies per Sec         TYPES OF CONSTRUCTION         CONSTRUCTION CLASSIFICATION         Occupancy       Occupance<br>B<br>Existing Indoor Shooting Range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | vvest vvali                                   |                                                                                      | 139-6                                                                                         |                  |
| Aa = At + [At x If] + [At x Is]         Section 506.3       Automatic Sprinkler System Increases         Where a building is equipped throughone Section 903.3.1.1 (NFPA 13), the area 300 percent (Is=3) for buildings with note that space and the space of the space | AREA MODIFIC                                  | ATIONS                                                                               |                                                                                               |                  |
| Aa = At + [At x If] + [At x Is]         Section 506.3       Automatic Sprinkler System Increases         Where a building is equipped throughone Section 903.3.1.1 (NFPA 13), the area 300 percent (Is=3) for buildings with note that space and the space of the space |                                               |                                                                                      |                                                                                               |                  |
| Section 506.3       Automatic Sprinkler System Increas:<br>Where a building is equipped througho<br>Section 903.3.1.1 (NFPA 13), the area<br>300 percent (Is=3) for buildings with no         MIXED USE AND OCCUPANCY         NONSEPARATED OCCUPANCIES (Between Exist)<br>Section 508.3.2         Nonseparated Occupancies<br>Nonseparated occupancies shall be in<br>Code requirements shall apply to eact<br>that space except that the most rest<br>building. The allowable area and heig<br>required between occupancies per Sec         TYPES OF CONSTRUCTION         CONSTRUCTION CLASSIFICATION         Occupancy       Occupance<br>Section Shooting Range         B       Existing Enclosed Parking Garage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                               |                                                                                      |                                                                                               |                  |
| Where a building is equipped throughor<br>Section 903.3.1.1 (NFPA 13), the area<br>300 percent (Is=3) for buildings with no         MIXED USE AND OCCUPANCY         NONSEPARATED OCCUPANCIES (Between Existing<br>Section 508.3.2         Nonseparated Occupancies<br>Nonseparated occupancies shall be in<br>Code requirements shall apply to eact<br>that space except that the most restring<br>building. The allowable area and heig<br>required between occupancies per Section<br>TYPES OF CONSTRUCTION         CONSTRUCTION CLASSIFICATION         Occupancy       Occupance<br>B<br>Existing Indoor Shooting Range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Aa = At + [At x If] +                         | [At x Is]                                                                            |                                                                                               |                  |
| NONSEPARATED OCCUPANCIES (Between Exist)           Section 508.3.2         Nonseparated Occupancies           Nonseparated occupancies shall be in Code requirements shall apply to each that space except that the most restribuilding. The allowable area and heig required between occupancies per Sector           TYPES OF CONSTRUCTION           CONSTRUCTION CLASSIFICATION           Occupancy         Occupance           Existing Indoor Shooting Range         B           Existing Enclosed Parking Garage         S-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Section 506.3                                 | Where a building is Section 903.3.1.1 (N                                             | equipped throughout<br>IFPA 13), the area lin                                                 |                  |
| Section 508.3.2       Nonseparated Occupancies         Nonseparated occupancies shall be in Code requirements shall apply to each that space except that the most restribuilding. The allowable area and heir required between occupancies per Sec         TYPES OF CONSTRUCTION         CONSTRUCTION CLASSIFICATION         Occupancy       Occupance         Existing Indoor Shooting Range       B         Existing Enclosed Parking Garage       S-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | MIXED USE AND                                 | OCCUPANCY                                                                            |                                                                                               |                  |
| Section 508.3.2       Nonseparated Occupancies         Nonseparated occupancies shall be in Code requirements shall apply to each that space except that the most restribuilding. The allowable area and heir required between occupancies per Sec         TYPES OF CONSTRUCTION         CONSTRUCTION CLASSIFICATION         Occupancy       Occupance         Existing Indoor Shooting Range       B         Existing Enclosed Parking Garage       S-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                               |                                                                                      |                                                                                               |                  |
| Nonseparated occupancies shall be in         Code requirements shall apply to each         that space except that the most rest         building. The allowable area and heir         required between occupancies per Sec         TYPES OF CONSTRUCTION         CONSTRUCTION CLASSIFICATION         Occupancy         Occupance         Existing Indoor Shooting Range       B         Existing Enclosed Parking Garage       S-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                               |                                                                                      |                                                                                               |                  |
| CONSTRUCTION CLASSIFICATION           Occupancy         Occupance           Existing Indoor Shooting Range         B           Existing Enclosed Parking Garage         S-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Section 508.3.2                               | Nonseparated occu<br>Code requirements<br>that space except t<br>building. The allow | pancies shall be indi<br>shall apply to each<br>that the most restrict<br>able area and heigh |                  |
| Occupancy         Occupanc           Existing Indoor Shooting Range         B           Existing Enclosed Parking Garage         S-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | TYPES OF CO                                   | ONSTRUCTION                                                                          |                                                                                               |                  |
| Existing Indoor Shooting Range B<br>Existing Enclosed Parking Garage S-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                               |                                                                                      | N                                                                                             |                  |
| Existing Enclosed Parking Garage S-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Occu                                          | pancy                                                                                | Occupancy                                                                                     |                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                               |                                                                                      |                                                                                               |                  |
| New Enclosed Parking Garage S-2 (Existing B Go                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                               |                                                                                      |                                                                                               |                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | New Enclosed Parl                             | king Garage                                                                          | S-2 (Existing B Gove                                                                          |                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | New Enclosed Parl                             | king Garage                                                                          | S-2 (Existing B Gov                                                                           |                  |

| FIRE-RESISTA<br>Build                                                                                                                    | INT REQUI                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                 | Occupancy                                                                                                                                                     |                                                                                                                          | )<br>Occupancy                                                                                                                 | Not                                                                                                                 | Table 601<br>Used                                                                                                                                                                  |
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| Dana                                                                                                                                     |                                                                                                                                                                                            | •                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                 | estrictive)                                                                                                                                                   |                                                                                                                          | is the Design)                                                                                                                 |                                                                                                                     | USCU                                                                                                                                                                               |
|                                                                                                                                          |                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                 | struction                                                                                                                                                     |                                                                                                                          | nstruction                                                                                                                     |                                                                                                                     |                                                                                                                                                                                    |
| Structural Frame:                                                                                                                        |                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0 hour                                                                                                                                                          |                                                                                                                                                               | 0 hour                                                                                                                   |                                                                                                                                |                                                                                                                     |                                                                                                                                                                                    |
| ncluding Column<br>Bearing Walls – E                                                                                                     |                                                                                                                                                                                            | nd Trusses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0 hour                                                                                                                                                          |                                                                                                                                                               | 0 hour                                                                                                                   |                                                                                                                                |                                                                                                                     |                                                                                                                                                                                    |
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| Non-Bearing Walls and Partitions:                                                                                                        |                                                                                                                                                                                            | 0 hour                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                 | 0 hour                                                                                                                                                        |                                                                                                                          |                                                                                                                                |                                                                                                                     |                                                                                                                                                                                    |
| Exterior                                                                                                                                 |                                                                                                                                                                                            | (see Table 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 602 below)                                                                                                                                                      |                                                                                                                                                               | 602 below)                                                                                                               |                                                                                                                                |                                                                                                                     |                                                                                                                                                                                    |
| Non-Bearing Wal<br>nterior                                                                                                               | Is and Partiti                                                                                                                                                                             | ons:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0 hour                                                                                                                                                          |                                                                                                                                                               | 0 hour                                                                                                                   |                                                                                                                                |                                                                                                                     |                                                                                                                                                                                    |
| loor Constructio                                                                                                                         | n:                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0 hour                                                                                                                                                          |                                                                                                                                                               | 0 hour                                                                                                                   |                                                                                                                                |                                                                                                                     |                                                                                                                                                                                    |
| ncluding Support                                                                                                                         |                                                                                                                                                                                            | and Joists                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                 |                                                                                                                                                               | J. Hour                                                                                                                  |                                                                                                                                |                                                                                                                     |                                                                                                                                                                                    |
| Roof Construction                                                                                                                        | n:                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0 hour                                                                                                                                                          |                                                                                                                                                               | 0 hour                                                                                                                   |                                                                                                                                |                                                                                                                     |                                                                                                                                                                                    |
| ncluding Support                                                                                                                         | ting Beams a                                                                                                                                                                               | and Joists                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                 |                                                                                                                                                               |                                                                                                                          |                                                                                                                                |                                                                                                                     |                                                                                                                                                                                    |
| FIRE-RESISTA                                                                                                                             |                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                 | DWALLER                                                                                                                                                       |                                                                                                                          |                                                                                                                                | DISTANCE                                                                                                            | Table 600                                                                                                                                                                          |
| Fire Separation                                                                                                                          |                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | pe of                                                                                                                                                           | Applicable                                                                                                                                                    |                                                                                                                          | SEFARATION                                                                                                                     |                                                                                                                     | oup S-2                                                                                                                                                                            |
| (Fee                                                                                                                                     |                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | struction                                                                                                                                                       | Approact                                                                                                                                                      |                                                                                                                          |                                                                                                                                |                                                                                                                     |                                                                                                                                                                                    |
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| 5≤X<                                                                                                                                     |                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                 |                                                                                                                                                               |                                                                                                                          |                                                                                                                                |                                                                                                                     |                                                                                                                                                                                    |
| 10 ≤ X                                                                                                                                   |                                                                                                                                                                                            | _                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                 |                                                                                                                                                               |                                                                                                                          |                                                                                                                                |                                                                                                                     |                                                                                                                                                                                    |
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|                                                                                                                                          |                                                                                                                                                                                            | RATED CO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                 |                                                                                                                                                               |                                                                                                                          |                                                                                                                                | СН                                                                                                                  | 0 hour                                                                                                                                                                             |
| FIRE-RESIS                                                                                                                               | TANCE-F                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                 | GS                                                                                                                                                            |                                                                                                                          | _                                                                                                                              |                                                                                                                     | APTER 7                                                                                                                                                                            |
| FIRE-RESIS                                                                                                                               | TANCE-F                                                                                                                                                                                    | ERIOR WA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                 | GS<br>Fire Separatio                                                                                                                                          |                                                                                                                          |                                                                                                                                |                                                                                                                     | APTER 7<br>Table 704.8                                                                                                                                                             |
| FIRE-RESIS                                                                                                                               | TANCE-F                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                 | GS                                                                                                                                                            | Greater                                                                                                                  | Feet)<br>Greater<br>0 than 20 to 25                                                                                            | Greater                                                                                                             | APTER 7                                                                                                                                                                            |
| FIRE-RESIS                                                                                                                               | TANCE-F                                                                                                                                                                                    | ERIOR WA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                 | GS<br>Fire Separatio<br>Greater                                                                                                                               | Greater                                                                                                                  | Greater                                                                                                                        | Greater                                                                                                             | APTER 7<br>Table 704.8<br>Greater<br>than 30<br>No Limit                                                                                                                           |
| FIRE-RESIS                                                                                                                               | TANCE-F                                                                                                                                                                                    | ERIOR WA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                 | GS<br>Fire Separatio<br>Greater                                                                                                                               | Greater                                                                                                                  | Greater                                                                                                                        | Greater                                                                                                             | APTER 7<br>Table 704.8<br>Greater<br>than 30                                                                                                                                       |
| FIRE-RESIS                                                                                                                               | TANCE-F                                                                                                                                                                                    | Greater<br>than 3 to 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | CONSTRUC                                                                                                                                                        | GS<br>Fire Separatio<br>Greater                                                                                                                               | Greater                                                                                                                  | Greater                                                                                                                        | Greater<br>than 25 to 30                                                                                            | APTER 7<br>Table 704.8<br>Greater<br>than 30<br>No Limit<br>No Limit                                                                                                               |
| FIRE-RESIS                                                                                                                               | TANCE-F<br>EA OF EXT<br>0 to 3<br>ECTION S                                                                                                                                                 | Greater<br>than 3 to 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | CONSTRUC<br>LL OPENIN<br>Greater<br>than 5 to 10                                                                                                                | GS<br>Fire Separatio<br>Greater                                                                                                                               | Greater                                                                                                                  | Greater                                                                                                                        | Greater<br>than 25 to 30                                                                                            | APTER 7<br>Table 704.8<br>Greater<br>than 30<br>No Limit<br>No Limit<br>IAPTER 9                                                                                                   |
| FIRE-RESIS                                                                                                                               | TANCE-F<br>EA OF EXT<br>0 to 3<br>ECTION S                                                                                                                                                 | Greater<br>than 3 to 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | CONSTRUC<br>LL OPENIN<br>Greater<br>than 5 to 10                                                                                                                | GS<br>Fire Separatio<br>Greater<br>than 10 to 15                                                                                                              | Greater<br>than 15 to 2                                                                                                  | Greater<br>0 than 20 to 25                                                                                                     | Greater<br>than 25 to 30                                                                                            | APTER 7<br>Table 704.8<br>Greater<br>than 30<br>No Limit<br>No Limit<br>IAPTER 9<br>Section 903                                                                                    |
| FIRE-RESIS                                                                                                                               | TANCE-F<br>EA OF EXT<br>0 to 3<br>ECTION S<br>EPRINKLEF<br>draulically ca                                                                                                                  | Greater<br>than 3 to 5<br>SYSTEMS<br>R SYSTEMS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | CONSTRUC<br>LL OPENIN<br>Greater<br>than 5 to 10                                                                                                                | GS<br>Fire Separatio<br>Greater<br>than 10 to 15                                                                                                              | Greater<br>than 15 to 2                                                                                                  | Greater                                                                                                                        | Greater<br>than 25 to 30                                                                                            | APTER 7<br>Table 704.8<br>Greater<br>than 30<br>No Limit<br>No Limit<br>IAPTER 9<br>Section 903                                                                                    |
| FIRE-RESIS                                                                                                                               | TANCE-F<br>EA OF EXT<br>0 to 3<br>ECTION S<br>EPRINKLEF<br>draulically ca                                                                                                                  | Greater<br>than 3 to 5<br>SYSTEMS<br>R SYSTEMS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | CONSTRUC<br>LL OPENIN<br>Greater<br>than 5 to 10                                                                                                                | GS<br>Fire Separatio<br>Greater<br>than 10 to 15                                                                                                              | Greater<br>than 15 to 2                                                                                                  | Greater<br>0 than 20 to 25                                                                                                     | Greater<br>than 25 to 30                                                                                            | APTER 7<br>Table 704.8<br>Greater<br>than 30<br>No Limit<br>No Limit<br>IAPTER 9<br>Section 903                                                                                    |
| AXIMUM ARI<br>Dassification<br>Of Opening<br>Jnprotected<br>Protected<br>TIRE PROTE                                                      | TANCE-F<br>EA OF EXT<br>0 to 3<br>ECTION S<br>PRINKLEF<br>draulically ca<br>g fire alarm<br>Automat                                                                                        | Greater<br>than 3 to 5<br>SYSTEMS<br>R SYSTEMS<br>Iculated auto<br>system.<br>ic Sprinkler                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | DNSTRUC<br>LL OPENIN<br>Greater<br>than 5 to 10<br>matic sprinkle<br>Systems                                                                                    | GS<br>Fire Separatio<br>Greater<br>than 10 to 15                                                                                                              | Greater<br>than 15 to 2                                                                                                  | Greater<br>0 than 20 to 25                                                                                                     | Greater<br>than 25 to 30<br>CH                                                                                      | APTER 7<br>Table 704.8<br>Greater<br>than 30<br>No Limit<br>No Limit<br>IAPTER 9<br>Section 903<br>nd connected                                                                    |
| AXIMUM ARI<br>Dassification<br>Of Opening<br>Jnprotected<br>Protected<br>TIRE PROTE                                                      | TANCE-F<br>EA OF EXT<br>0 to 3<br>ECTION S<br>EPRINKLEF<br>draulically ca<br>g fire alarm :<br>Automatic                                                                                   | Greater<br>than 3 to 5<br>SYSTEMS<br>CSYSTEMS<br>Inculated auto<br>system.<br>ic Sprinkler<br>c sprinkler s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | DNSTRUC<br>LL OPENIN<br>Greater<br>than 5 to 10<br>matic sprinkle<br>Systems<br>ystem provid                                                                    | GS<br>Fire Separatio<br>Greater<br>than 10 to 15<br>er system is pro                                                                                          | Greater<br>than 15 to 2<br>wided through<br>the with Se                                                                  | Greater<br>than 20 to 25<br>hout all areas o<br>ction 302.3.1-N                                                                | Greater<br>than 25 to 30<br>CH<br>of the project a                                                                  | APTER 7<br>Table 704.8<br>Greater<br>than 30<br>No Limit<br>No Limit<br>IAPTER 9<br>Section 903<br>nd connected                                                                    |
| AXIMUM ARI<br>Dassification<br>Of Opening<br>Jnprotected<br>Protected<br>TIRE PROTE                                                      | TANCE-F<br>EA OF EXT<br>0 to 3<br>ECTION S<br>EPRINKLEF<br>draulically ca<br>ig fire alarm<br>Automatic<br>Occupan                                                                         | Greater<br>than 3 to 5<br>SYSTEMS<br>CSYSTEMS<br>CONSTRUST<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACTOR<br>CONTRACT                                                          | DNSTRUC<br>LL OPENIN<br>Greater<br>than 5 to 10<br>matic sprinkle<br>Systems<br>ystem provide<br>2 provided w                                                   | GS<br>Fire Separatio<br>Greater<br>than 10 to 15<br>er system is pro<br>ed in complian<br><i>i</i> th automatic                                               | Greater<br>than 15 to 2<br>wided throug<br>nce with Se<br>sprinkler sys                                                  | Greater<br>0 than 20 to 25<br>hout all areas o<br>ction 302.3.1-N<br>stem. Entire bui                                          | Greater<br>than 25 to 30<br>CH<br>f the project a<br>onseparated<br>ilding must be                                  | APTER 7<br>Table 704.8<br>Greater<br>than 30<br>No Limit<br>No Limit<br>IAPTER 9<br>Section 903<br>nd connected                                                                    |
| AXIMUM ARI<br>Dassification<br>Of Opening<br>Jnprotected<br>Protected<br>TIRE PROTE                                                      | TANCE-F<br>EA OF EXT<br>0 to 3<br>ECTION S<br>PRINKLEF<br>draulically ca<br>g fire alarm :<br>Automati<br>Occupan<br>Automati                                                              | Greater<br>than 3 to 5<br>SYSTEMS<br>RSYSTEMS<br>RSYSTEMS<br>Idculated auto<br>system.<br>ic Sprinkler<br>c sprinkler s<br>cy B and S-<br>cy S and S-<br>cy S and S-<br>cy S and S-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | DNSTRUC<br>LL OPENIN<br>Greater<br>than 5 to 10<br>matic sprinkle<br>Systems<br>ystem provid<br>2 provided w<br>ystem is to                                     | GS<br>Fire Separatio<br>Greater<br>than 10 to 15<br>er system is pro-<br>er system is pro-<br>ed in complian<br><i>i</i> th automatic :<br>be designed a      | Greater<br>than 15 to 2<br>wided throug<br>nce with Se<br>sprinkler sys                                                  | Greater<br>than 20 to 25<br>hout all areas o<br>ction 302.3.1-N                                                                | Greater<br>than 25 to 30<br>CH<br>f the project a<br>onseparated<br>ilding must be<br>a accordance                  | APTER 7<br>Table 704.8<br>Greater<br>than 30<br>No Limit<br>No Limit<br>IAPTER 9<br>Section 903<br>and connected<br>Use. Existing<br>e sprinklered.<br>with Section                |
| AXIMUM ARI<br>Dassification<br>of Opening<br>Jnprotected<br>Protected<br>FIRE PROTE                                                      | TANCE-F<br>EA OF EXT<br>0 to 3<br>ECTION S<br>PRINKLEF<br>draulically ca<br>ig fire alarm s<br>Automati<br>Occupan<br>Automati<br>Occupan<br>Automati<br>903.3.1.1                         | Greater<br>than 3 to 5<br>GYSTEMS<br>CYSTEMS<br>CONSTEMS<br>CONSTEMS<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CONSTRUCT<br>CO | DNSTRUC<br>LL OPENIN<br>Greater<br>than 5 to 10<br>matic sprinkle<br>Systems<br>ystem provide<br>2 provided w<br>pystem is to<br>standards. NF                  | GS<br>Fire Separatio<br>Greater<br>than 10 to 15<br>er system is pro-<br>er system is pro-<br>ed in complian<br>thautomatic<br>be designed is<br>PA 13 system | Greater<br>than 15 to 2<br>wided throug<br>noce with Se<br>sprinkler sys<br>and installer<br>required fo                 | Greater<br>0 than 20 to 25<br>hout all areas of<br>ction 302.3.1-N<br>stem. Entire build throughout in                         | Greater<br>than 25 to 30<br>CH<br>f the project a<br>onseparated<br>inding must be<br>n accordance<br>in compliance | APTER 7<br>Table 704.8<br>Greater<br>than 30<br>No Limit<br>No Limit<br>IAPTER 9<br>Section 903<br>and connected<br>Use. Existing<br>e sprinklered.<br>with Section                |
| FIRE-RESIS VAXIMUM ARI Classification Of Opening Unprotected Protected FIRE PROTE AUTOMATIC S Dry-pipe, hydro the buildin Section 903    | TANCE-F<br>EA OF EXT<br>0 to 3<br>ECTION S<br>ERINKLEF<br>draulically ca<br>g fire alarm :<br>Automati<br>Occupan<br>Automati<br>903.3.1.1<br>506.3-Aut                                    | Greater<br>than 3 to 5<br>SYSTEMS<br>CYSTEMS<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUC                                                                                                                                              | DNSTRUC<br>LL OPENIN<br>Greater<br>than 5 to 10<br>matic sprinkle<br>Systems<br>ystem provide<br>2 provided w<br>pystem is to<br>standards. NF                  | GS<br>Fire Separatio<br>Greater<br>than 10 to 15<br>er system is pro-<br>er system is pro-<br>ed in complian<br>thautomatic<br>be designed is<br>PA 13 system | Greater<br>than 15 to 2<br>wided throug<br>noce with Se<br>sprinkler sys<br>and installer<br>required fo                 | Greater<br>0 than 20 to 25<br>hout all areas of<br>thout all areas of<br>thoughout in<br>throughout in<br>area increase        | Greater<br>than 25 to 30<br>CH<br>f the project a<br>onseparated<br>inding must be<br>n accordance<br>in compliance | APTER 7<br>Table 704.8<br>Greater<br>than 30<br>No Limit<br>No Limit<br>IAPTER 9<br>Section 903<br>and connected<br>Use. Existing<br>e sprinklered.<br>with Section                |
| FIRE-RESIS MAXIMUM ARI Classification Of Opening Unprotected Protected FIRE PROTE AUTOMATIC S I. Dry-pipe, hydro the buildin Section 903 | TANCE-F<br>EA OF EXT<br>0 to 3<br>ECTION S<br>ECTION S<br>BRINKLEF<br>draulically ca<br>ig fire alarm :<br>Automati<br>Occupan<br>Automati<br>903.3.1.1<br>506.3-Au<br>Group S             | Greater<br>than 3 to 5<br>SYSTEMS<br>CYSTEMS<br>CONSTEMS<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION<br>CONSTRUCTION                                                                                                                                              | DNSTRUC<br>LL OPENIN<br>Greater<br>than 5 to 10<br>matic sprinkle<br>Systems<br>ystem provide<br>2 provided w<br>system is to<br>standards. NF<br>kler System I | GS<br>Fire Separatio<br>Greater<br>than 10 to 15<br>er system is pro-<br>ed in complian<br>/ith automatic<br>be designed<br>FPA 13 system<br>ncrease for 300  | Greater<br>than 15 to 2<br>wided throug<br>nce with Se<br>sprinkler sys<br>and installer<br>required fo<br>) percent (Is | Greater<br>0 than 20 to 25<br>whout all areas of<br>thout all areas of<br>thoughout in<br>r area increase<br>= 3) for single-s | Greater<br>than 25 to 30<br>CH<br>onseparated<br>ilding must be<br>accordance<br>in compliance<br>tory building.    | APTER 7<br>Table 704.8<br>Greater<br>than 30<br>No Limit<br>No Limit<br>IAPTER 9<br>Section 903<br>nd connected<br>Use. Existing<br>e sprinklered.<br>with Section                 |
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|                | vision of Chapter 9 shall apply to the entire<br>in the most restrictive. No fire separation is |
|----------------|-------------------------------------------------------------------------------------------------|
|                | CHAPTER 6                                                                                       |
| assification   | Minimum Construction Type                                                                       |
|                | Type IIB - Fully sprinklered (NFPA 13)                                                          |
| ns the Design) | Type IIB - Fully sprinklered (NFPA 13)                                                          |

| e than one story above grade plane.                                                                                                                                                    |                                                    |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|--|--|--|--|
|                                                                                                                                                                                        | Section 508                                        |  |  |  |  |
| Building and New Building S-2)                                                                                                                                                         | Section 508.3.2                                    |  |  |  |  |
| dually classified in accordance with Sec<br>rtion of the building based on the occu<br>e applicable provision of Chapter 9 sh<br>shall be based on the most restrictive.<br>508.3.2.3. | pancy classification of<br>all apply to the entire |  |  |  |  |

|         | W = weighted average of the open space widths             |
|---------|-----------------------------------------------------------|
|         |                                                           |
|         |                                                           |
| ith an  | approved automatic sprinkler system in accordance with    |
|         | n Table 503 is permitted to be increased by an additional |
| re than | one story above grade plane.                              |

| e. New with the | s originally evaluated as a nonseparated mixed use with<br>building addition with Occupancy S-2 is evaluated as a<br>existing building. Existing Occupancy B tabular area<br>type of construction and applies to the entire building. |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| nches)          | Description                                                                                                                                                                                                                           |
|                 | From new building to property line                                                                                                                                                                                                    |
|                 | From new building to property line                                                                                                                                                                                                    |
|                 | 366'-4" From existing building to property line                                                                                                                                                                                       |
|                 | From new building to property line                                                                                                                                                                                                    |
|                 | Section 506                                                                                                                                                                                                                           |
|                 | FRONTAGE INCREASE (If)                                                                                                                                                                                                                |
|                 | If = [F/P - 0.25] x W/30                                                                                                                                                                                                              |
|                 | W musichted evenes of the onen ences widthe                                                                                                                                                                                           |

|       |                                                                                                                              | Table 503, Section 50                                |
|-------|------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| тсу   | New S-2 Occupancy<br>(B Governs the Design)                                                                                  | Not Used                                             |
|       | IIB construction                                                                                                             |                                                      |
|       | 26000                                                                                                                        |                                                      |
|       | Not taken                                                                                                                    |                                                      |
|       | 26000x(3)=78000                                                                                                              |                                                      |
|       | 26000+78000=104000                                                                                                           |                                                      |
|       | N/A                                                                                                                          |                                                      |
|       | 104,000 > 33,601                                                                                                             |                                                      |
| lew h | s originally evaluated as a r<br>building addition with Occup<br>existing building. Existing<br>type of construction and app | oancy S-2 is evaluated as<br>Occupancy B tabular are |

 
 NUMBER OF EXITS AND CONTINUITY

 Section 1019.1
 Minimum Number of Exits

 Section 1019.1.1
 Parking Structures

 Parking structures shall not have less than two exits from each parking tier.
 Section 1019 
 EXIT DISCHARGE
 Section 1024

 Section 1024.1
 Exits shall discharge directly to the exterior of the building. The exit discharge shall be at grade or shall provide direct access to grade. The exit discharge shall not re-enter a building.
 ACCESSIBILITY CHAPTER 11 ACCESSIBLE ROUTE Section 1104.1 Site Arrival Points (Existing) Section 1104 Section 1104.2 Within a Site (Existing)

| Section 1014.3                                                                                      | Commo                                                                                                                                                                                                         | n Dath of                         | Egress Trav                 |                  |                                                                     |                            | 5                                                                       | Section 1014                                                                                           |
|-----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-----------------------------|------------------|---------------------------------------------------------------------|----------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Exception 1:                                                                                        |                                                                                                                                                                                                               |                                   |                             |                  | Group S occupan                                                     | cies shall no              | t he more than 1                                                        | 100 feet since                                                                                         |
| Exception 1.                                                                                        | Length of a common path of egress travel in Group S occupancies shall not be more than 100 feet, since<br>the building is equipped throughout with an automatic sprinkler system installed in accordance with |                                   |                             |                  |                                                                     |                            |                                                                         |                                                                                                        |
|                                                                                                     |                                                                                                                                                                                                               |                                   | (NFPA 13).                  | gilout with      | an autonatic spin                                                   | ikiel system               | installed in act                                                        | cordance with                                                                                          |
|                                                                                                     | ocouoni                                                                                                                                                                                                       | 00.0.1.1                          | (ini i /i io).              |                  |                                                                     |                            |                                                                         |                                                                                                        |
| EXIT AND EXIT                                                                                       | ACCESS                                                                                                                                                                                                        | DOORV                             | VAYS                        |                  |                                                                     |                            | S                                                                       | Section 1015                                                                                           |
| Section 1015.1                                                                                      | Exit or E                                                                                                                                                                                                     | xit Acces                         | ss Doorways                 | Required         |                                                                     |                            |                                                                         |                                                                                                        |
|                                                                                                     |                                                                                                                                                                                                               |                                   |                             |                  | ny space shall be p                                                 | provided who               | ere the occupan                                                         | cy load of the                                                                                         |
|                                                                                                     | space ex                                                                                                                                                                                                      | ceeds the                         | e values in Ta              | able 1015.1 (    | See below).                                                         |                            |                                                                         |                                                                                                        |
| Section 1015.2.1                                                                                    | Two Exi                                                                                                                                                                                                       | ts or Exit                        | Access Doo                  | orway Arran      | gement                                                              |                            |                                                                         |                                                                                                        |
| Exception 2:                                                                                        | Where a                                                                                                                                                                                                       | building                          | is equipped t               | throughout w     | ith an automatic sp                                                 | orinkler syste             | em, the separation                                                      | on distance o                                                                                          |
|                                                                                                     | the exit                                                                                                                                                                                                      | doors or                          | exit access                 | doorways sh      | all not be less that                                                | n one-third                | of the length of                                                        | the maximun                                                                                            |
|                                                                                                     | overall d                                                                                                                                                                                                     | iagonal di                        | mension of th               | ne area serve    | ed.                                                                 |                            |                                                                         |                                                                                                        |
|                                                                                                     |                                                                                                                                                                                                               |                                   |                             |                  |                                                                     |                            |                                                                         |                                                                                                        |
| SPACES WITH                                                                                         | ONE MEA                                                                                                                                                                                                       | NS OF                             | EGRESS                      |                  | MINIMUM NO.C                                                        | OF EXITS F                 | OR OCCUPAI                                                              | NT LOAD                                                                                                |
| Table 1015.1                                                                                        |                                                                                                                                                                                                               |                                   | -                           |                  | Table 1019.1                                                        |                            |                                                                         |                                                                                                        |
| Occupancy/Class                                                                                     | ification                                                                                                                                                                                                     | Maxin                             | num Occupancy Occupancy     |                  |                                                                     |                            |                                                                         |                                                                                                        |
|                                                                                                     |                                                                                                                                                                                                               |                                   | Load                        |                  | (Persons per                                                        | story)                     |                                                                         |                                                                                                        |
| Parking Garage                                                                                      | S                                                                                                                                                                                                             |                                   | 29                          |                  | 1 - 500<br>501 - 1000                                               |                            | 2                                                                       | Required                                                                                               |
|                                                                                                     |                                                                                                                                                                                                               |                                   |                             |                  |                                                                     |                            |                                                                         |                                                                                                        |
| • •                                                                                                 |                                                                                                                                                                                                               |                                   |                             |                  |                                                                     |                            | 3                                                                       | N/A                                                                                                    |
| • •                                                                                                 |                                                                                                                                                                                                               |                                   |                             |                  | More Than 1000                                                      |                            | 3 4                                                                     | N/A<br>N/A                                                                                             |
|                                                                                                     | ACCESS                                                                                                                                                                                                        | DOORS                             | WAYS (200                   | D6 IBC Den       |                                                                     | s)                         | 4                                                                       | N/A                                                                                                    |
|                                                                                                     |                                                                                                                                                                                                               |                                   | WAYS (200                   | 06 IBC Den       | More Than 1000                                                      | s)<br>Factor               | 4                                                                       | N/A<br>Section 1018                                                                                    |
|                                                                                                     |                                                                                                                                                                                                               |                                   |                             |                  | More Than 1000                                                      | -                          | 4                                                                       | N/A<br>Section 1018                                                                                    |
| EXIT AND EXIT<br>Occupancy/C                                                                        | lassificat                                                                                                                                                                                                    | ion                               | Level                       | Occupan          | More Than 1000<br>ver Amendments<br>cy No. of Exits                 | Factor                     | 4<br>S                                                                  | N/A<br>Section 1018                                                                                    |
| EXIT AND EXIT<br>Occupancy/C<br>EXIT AND EXIT AN                                                    | lassificat                                                                                                                                                                                                    | ion<br>ROM BUII                   | Level                       | Occupane<br>Load | More Than 1000<br>ver Amendments<br>y No. of Exits<br>Required      | Factor<br>(0.175)          | 4<br>Exits Width<br>Required<br>(Inches)                                | N/A<br>Section 1018<br>Exit Width<br>Provided<br>(Inches)                                              |
|                                                                                                     | lassificat                                                                                                                                                                                                    | ion                               | Level                       | Occupan          | More Than 1000<br>ver Amendments<br>cy No. of Exits                 | Factor                     | 4<br>Exits Width<br>Required                                            | N/A<br>Section 1015<br>Exit Width<br>Provided                                                          |
| EXIT AND EXIT<br>Occupancy/C<br>EXIT AND EXIT A<br>Parking Garage                                   | CCESS FF                                                                                                                                                                                                      | ion<br>ROM BUII<br>S-2            | Level<br>LDING<br>N/A       | Occupane<br>Load | More Than 1000<br>ver Amendments<br>y No. of Exits<br>Required      | Factor<br>(0.175)          | 4<br>Exits Width<br>Required<br>(Inches)<br>7 inches                    | N/A<br>Section 1018<br>Exit Width<br>Provided<br>(Inches)<br>72 inches                                 |
| EXIT AND EXIT<br>Occupancy/C<br>EXIT AND EXIT A<br>Parking Garage                                   | CCESS FF                                                                                                                                                                                                      | ion<br>ROM BUII<br>S-2            | Level<br>LDING<br>N/A       | Occupane<br>Load | More Than 1000<br>ver Amendments<br>y No. of Exits<br>Required      | Factor<br>(0.175)          | 4<br>Exits Width<br>Required<br>(Inches)<br>7 inches                    | N/A<br>Section 1018<br>Exit Width<br>Provided<br>(Inches)<br>72 inches                                 |
| EXIT AND EXIT<br>Occupancy/C<br>EXIT AND EXIT AN                                                    | CCESS FF                                                                                                                                                                                                      | ion<br>ROM BUII<br>S-2<br>DISTANC | Level                       | Occupane<br>Load | More Than 1000<br>ver Amendments<br>y No. of Exits<br>Required      | Factor<br>(0.175)          | 4<br>Exits Width<br>Required<br>(Inches)<br>7 inches                    | N/A<br>Section 1015<br>Exit Width<br>Provided<br>(Inches)<br>72 inches<br>Section 1016                 |
| EXIT AND EXIT<br>Occupancy/C<br>EXIT AND EXIT A<br>Parking Garage<br>EXIT ACCESS T<br>EXIT ACCESS T | RAVEL I                                                                                                                                                                                                       | ION<br>ROM BUII<br>S-2<br>DISTANC | Level<br>LDING<br>N/A<br>CE | Occupane<br>Load | More Than 1000<br>ver Amendments<br>y No. of Exits<br>Required<br>2 | Factor<br>(0.175)<br>0.175 | 4<br>Exits Width<br>Required<br>(Inches)<br>7 inches<br>Section 1016, 1 | N/A<br>Section 1018<br>Exit Width<br>Provided<br>(Inches)<br>72 inches<br>Section 1016<br>Table 1016.1 |
| EXIT AND EXIT<br>Occupancy/C<br>EXIT AND EXIT A<br>Parking Garage<br>EXIT ACCESS T                  | RAVEL I                                                                                                                                                                                                       | ION<br>ROM BUII<br>S-2<br>DISTANC | Level<br>LDING<br>N/A<br>CE | Occupane<br>Load | More Than 1000<br>ver Amendments<br>y No. of Exits<br>Required<br>2 | Factor<br>(0.175)<br>0.175 | 4<br>Exits Width<br>Required<br>(Inches)<br>7 inches                    | N/A<br>Section 1018<br>Exit Width<br>Provided<br>(Inches)<br>72 inches<br>Section 1016<br>Table 1016.1 |

| Section 1002.1                                   | under consider<br>closets, the thic                                                                                                                                                                                                                       | ation, exclu<br>kness of in<br>, NET: The | usive of ve<br>terior walls,<br>e actual oc | ent shafts and<br>columns or oth<br>coupied area no | courts,<br>er featu<br>ot inclu | without deduction for<br>res.<br>ding unoccupied acc | or walls of the building<br>or corridors, stairways<br>essory areas such as |
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|---------------------------------------------|-----------------------------------------------------|---------------------------------|------------------------------------------------------|-----------------------------------------------------------------------------|
| OCCUPANCY L                                      | OAD                                                                                                                                                                                                                                                       |                                           |                                             |                                                     |                                 |                                                      | Section 1004                                                                |
| MAXIMUM FLO                                      | OR AREA ALL                                                                                                                                                                                                                                               | OWANCE                                    | S PER OC                                    | CUPANT                                              |                                 |                                                      | Table 1004.1.1                                                              |
| Occupar                                          | ncy/Classification                                                                                                                                                                                                                                        | n                                         |                                             | rea in Sq. Ft.<br>Occupant                          |                                 | Area<br>(Square feet)                                | Occupants<br>(Total)                                                        |
| Parking Garage                                   |                                                                                                                                                                                                                                                           | S-2                                       | 200 gros                                    | s                                                   | 6835                            | 1                                                    | 35 Occupants                                                                |
| EGRESS WIDTH                                     | 4                                                                                                                                                                                                                                                         |                                           |                                             |                                                     |                                 |                                                      | Section 100                                                                 |
| EGRESS WIDTH                                     |                                                                                                                                                                                                                                                           |                                           | ED (2006                                    | IBC Denver                                          | Amend                           | ments)                                               | Table 1005.                                                                 |
| Occupancy/Cl                                     |                                                                                                                                                                                                                                                           |                                           |                                             | nkler System                                        | inena                           | With Sprinkler System                                |                                                                             |
|                                                  |                                                                                                                                                                                                                                                           |                                           | ways<br>r Occupant)                         | Other Egr<br>Compone<br>(Inches per Occ             | nts                             | Stairways<br>(Inches per Occupant)                   | Other Egress<br>Components<br>(Inches per Occupant)                         |
| Parking Garage                                   | S-2                                                                                                                                                                                                                                                       | N                                         | /A                                          | N/A                                                 |                                 | N/A                                                  | 0.175                                                                       |
| Section 1005.1<br>MEANS OF EGF<br>Section 1006.1 | the available ca                                                                                                                                                                                                                                          | of egress s<br>pacity to les              | shall be size<br>ss than 50 p               | percent of the re                                   | equired o                       | capacity.                                            | gress shall not reduce<br>Section 1000                                      |
| ACCESSIBLE M                                     | EANS OF EGR                                                                                                                                                                                                                                               | ESS                                       |                                             |                                                     |                                 |                                                      | Section 100                                                                 |
| Section 1007.1                                   | Accessible Means of Egress Required<br>Where more than one means of egress is required by Section 1015.1 or 1019.1 from any accessible<br>space, each accessible portion of the space shall be served by not less than two accessible means of<br>egress. |                                           |                                             |                                                     |                                 |                                                      |                                                                             |
| DOORS, GATES                                     |                                                                                                                                                                                                                                                           | ILES                                      |                                             |                                                     |                                 |                                                      | Section 100                                                                 |
| Section 1008.1.1<br>Section 1008.1.2             | Minimum width<br>Door Swing                                                                                                                                                                                                                               |                                           |                                             |                                                     |                                 | not less than 32 inche<br>ng an occupant load c      | s.<br>f 50 or more persons.                                                 |

 EXIT SIGNS

 Section 1011.1
 Exit signs provided in compliance with 2006 IBC, Section 1011.

 FIRE ALARM AND DETECTION SYSTEMS
 Section 907

 Section 907.2
 Fire Alarm and Detection Systems Approved automatic fire alarm system shall be installed in accordance with the provisions of the IBC and

Approved automatic fire alarm system shall be installed in accordance with the provisions of the IBC and NFPA 72 and connected to the existing building fire alarm system. Where automatic sprinkler protection, installed in accordance with Section 903.3.1.1 (NFPA 13), is provided and connected to the building fire alarm system, automatic heat detection shall not be required.
 Section 907.13 Fire-Extinguishing Systems shall be connected to the building fire alarm system where a fire alarm system is required.

CHAPTER 10

Section 1011

MEANS OF EGRESS

ACCESSIBLE ENTRANCES Section 1105.1 Public Entrances Exception 1: An accessible entrance is not require ROOF ASSEMBLIES AND ROOFTOP FIRE CLASSIFICATION Section 1505.1 Roof covering classification shall be MINIMUM ROOF COVERING CLASSIFICATIO

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|      |                                        |                 | Se            | ection 1105 |           |  |
|------|----------------------------------------|-----------------|---------------|-------------|-----------|--|
| quir | ed to areas no                         | t required to b | e accessible. |             |           |  |
| S    | RUCTURI                                | ES              |               | SEG         | CTION 15  |  |
|      |                                        |                 |               | SEC         | TION 1505 |  |
| be   | be Class C per 2006 IBC, Table 1505.1. |                 |               |             |           |  |
| N    | FOR TYPES                              | OF CONSTR       | Та            | able 1505.1 |           |  |
|      | IIIA                                   | IIIB            | IV            | VA          | VB        |  |
|      |                                        |                 |               |             |           |  |
| _    |                                        |                 |               |             |           |  |

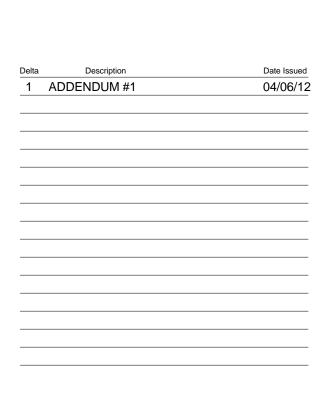
| CODE    | CODE LEGEND                                               |  |  |  |  |
|---------|-----------------------------------------------------------|--|--|--|--|
| -       | DIRECTION OF BUILDING EGRESS                              |  |  |  |  |
| <b></b> | DIRECTION OF INTERIOR EGRESS                              |  |  |  |  |
| 2       | DIRECTION OF AREA EGRESS w/ NUMBER OF OCCUPANTS INDICATED |  |  |  |  |
|         | ACCESSIBLE ROUTE                                          |  |  |  |  |
|         | FIRE DEPARTMENT ACCESS                                    |  |  |  |  |
| — КВ    | FIRE DEPARTMENT KNOX BOX                                  |  |  |  |  |
| ••••    | SMOKE BARRIER                                             |  |  |  |  |
| FCP     | FIRE CONTROL PANEL                                        |  |  |  |  |
| FEC     | FIRE EXTINGUISHER CABINET                                 |  |  |  |  |

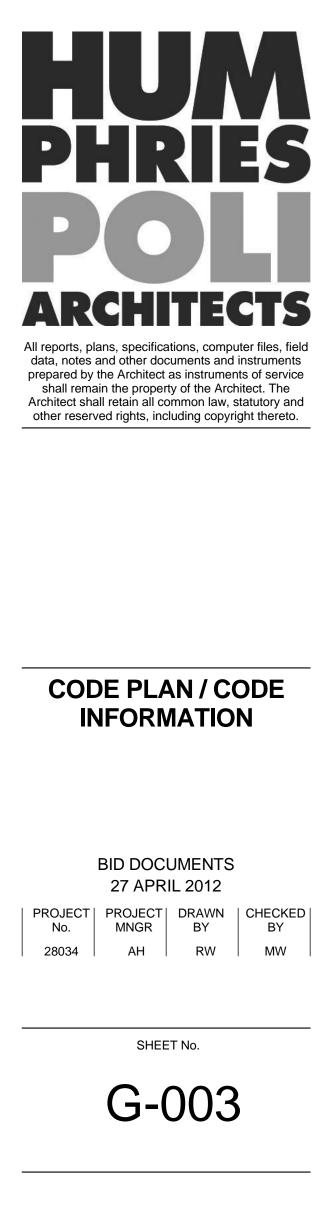
**NEW ADDITION** 



3501 Park Avenue

Denver, CO 80216





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## **LEGAL DESCRIPTION:**

A parcel of land located in the West Half of the Northwest Quarter of Section 27, Township 3 South, Range 68 West of the Sixth Principal Meridian, City and County of Denver, State of Colorado, being more particularly described as follows:

BEGINNING at the Southwest Corner of the Northwest Quarter of said Northwest Quarter;

THENCE North 00°00'57" East, a distance of 206.47 Feet, along the westerly line of said Northwest Quarter; THENCE North 89°56'49" East, a distance of 290.93 Feet, along the northerly line of Parcel 1 as described in a deed to the City and County of Denver recorded at Reception No. 2005072461 in the Clerk and Recorder's Office, to a point of nontangent curvature;

THENCE with a nontangent curve to the left, the center of bears North 29°01'43" East, with a radius of 604.80 feet, through a central angle of 7°21'24", along an arc length of 77.66 feet, with a chord bearing of South 64°38'59" East, a distance of 77.60 feet, along a northeasterly line of said Parcel 1 THENCE South 03°14'32" East, a distance of 73.29 Feet, along the westerly line of an exception to said Parcel 1, which is further described in said deed as Parcel "C" of an instrument recorded at Reception No. 9500036184, to the

Southwest Corner of said exception to Parcel 1; THENCE South 03°14'45" East, a distance of 289.95 Feet, along an easterly line of Parcel No. R3 as described in a deed to the City and County of Denver recorded at Reception No. 9800047320 in the Clerk and Recorder's Office; THENCE South 09°41'36" East, a distance of 235.83 Feet, along an easterly line of said Parcel No. R3; THENCE North 89°56'49" East, a distance of 39.50 Feet, along a northerly line of Parcel 2 as described in said deed to

the City and County of Denver recorded at Reception No. 2005072461; THENCE South 00°34'16" East, a distance of 324.52 Feet, along the westerly line of the exceptions to said Parcel 2, which are further described in said deed as Parcels "A" and "B" of an instrument recorded at Reception No. 9500036184;

THENCE South 49°02'17" West, a distance of 359.13 Feet, along the Northwesterly line of the South Platte River as described in Ordinance No. 25, Series of 1984, to a point of curvature; THENCE along a curve to the right, with a radius of 520.53 feet, through a central angle of 11°53'37", along an arc

length of 108.05 feet, with a chord bearing of South 54°59'06" West, a distance of 107.86 feet, continuing along said Northwesterly line of the South Platte River to a point of nontangent compound curvature; THENCE with a compound curve to the right, the center of bears North 47°18'41" East, with a radius of 744.49 feet, through a central angle of 3°30'47", along an arc length of 45.65 feet, with a chord bearing of North 40°55'56" West,

a distance of 45.64 feet, along a southwesterly line of said Parcel 2 to a point of nontangency; THENCE North 00°00'57" East, a distance of 611.99 Feet, along a westerly line of said Parcel 2;

THENCE South 89°56'49" West, a distance of 74.96 Feet, along the southerly line of said Parcel 1;

THENCE North 00°00'57" East, a distance of 397.00 Feet, along the westerly line of said Parcel 1, also being the westerly line of said Northwest Quarter, to the POINT OF BEGINNING.

Containing an area of 426,761 Square Feet or 9.7971 Acres, more or less.

## **GENERAL NOTES:**

1. BASIS OF BEARINGS: THE BEARINGS SHOWN HEREON ARE BASED ON THE WEST LINE OF THE NORTHWEST QUARTER OF SECTION 27, TOWNSHIP 3 SOUTH, RANGE 68 WEST, 6th P.M., MONUMENTED SHOWN HEREON, BEARING NORTH 0°00'57" WEST BASED ON THE CITY & COUNTY OF DENVER LOCAL COORDINATE SYSTEM.

2. BENCHMARK: CITY & COUNTY OF DENVER BM-499A, LOCATED AT PECOS ST. AND 32ND AVE., CCD BRASS CAP, S.E. CORNER TOP OF CURB @ E END OF INLET WITH AN ELEVATION OF 5212.45 NAVD 1988.

3. UTILITY LOCATIONS ARE BASED SURFACE EVIDENCE PLUS MAPPING RECEIVED FROM DENVER WATER, DENVER WASTEWATER AND XCEL.

4. SURVEY WAS PROVIDED BY ALTA SURVEYING, INC.

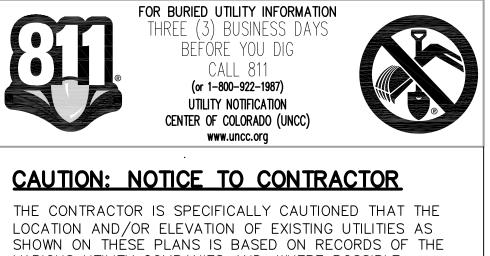
## **OWNER:**

CITY AND COUNTY OF DENVER 201 W. COLFAX AVE. DENVER, CO 80202

# **CIVIL ENGINEER:**

HCL ENGINEERING & SURVEYING, LLC 9570 KINGSTON CT., STE. 310 ENGLEWOOD, CO 80112

**BENCHMARK:**\_CITY & COUNTY OF DENVER BM-499A, LOCATED AT PECOS ST. AND 32ND AVE., CCD BRASS CAP, S.E. CORNER TOP OF CURB @ E END OF INLET WITH AN ELEVATION OF 5212.45 NAVD 1988.



VARIOUS UTILITY COMPANIES AND, WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE LOCAL UTILITY LOCATION CENTER AT LEAST 48 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATIONS OF THE UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS.

# CONSTRUCTION DOCUMENTS FOR

# DENVER TRAFFIC OPERATIONS COMMAND VEHICLE STORAGE

LOCATED IN THE NW 1/4 OF SECTION 27, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M. CITY AND COUNTY OF DENVER, STATE OF COLORADO 3375 & 3501 PARK AVENUE WEST





VICINITY MAP APPROX. SCALE: 1"=1000'

SHEET INDEX

| C-100 | COVER SHEET             |
|-------|-------------------------|
| C-101 | DEMOLITION PLAN         |
| C-102 | HORIZONTAL CONTROL PLAN |
| C-103 | GRADING & UTILITY PLAN  |
| C-104 | EROSION CONTROL PLAN    |
| C-105 | EROSION CONTROL DETAILS |
| C-106 | OVERALL DRAINAGE PLAN   |
|       |                         |

I HEREBY AFFIRM THAT THESE FINAL CONSTRUCTION PLANS WERE PREPARED BY ME (OR UNDER MY DIRECT SUPERVISION) IN ACCORDANCE WITH THE REQUIREMENTS OF THE CITY AND COUNTY OF DENVER DESIGN CRITERIA AND STANDARD SPECIFICATIONS.

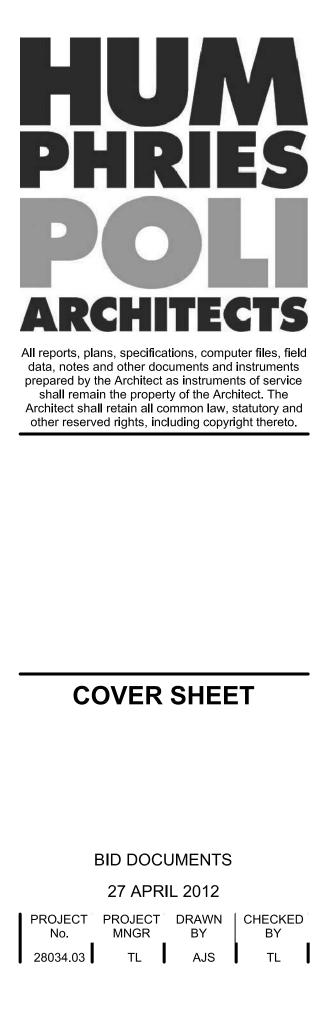
JASPER L. HERRERA, P.E. #31293 FOR AND ON BEHALF OF HCL ENGINEERING & SURVEYING, LLC





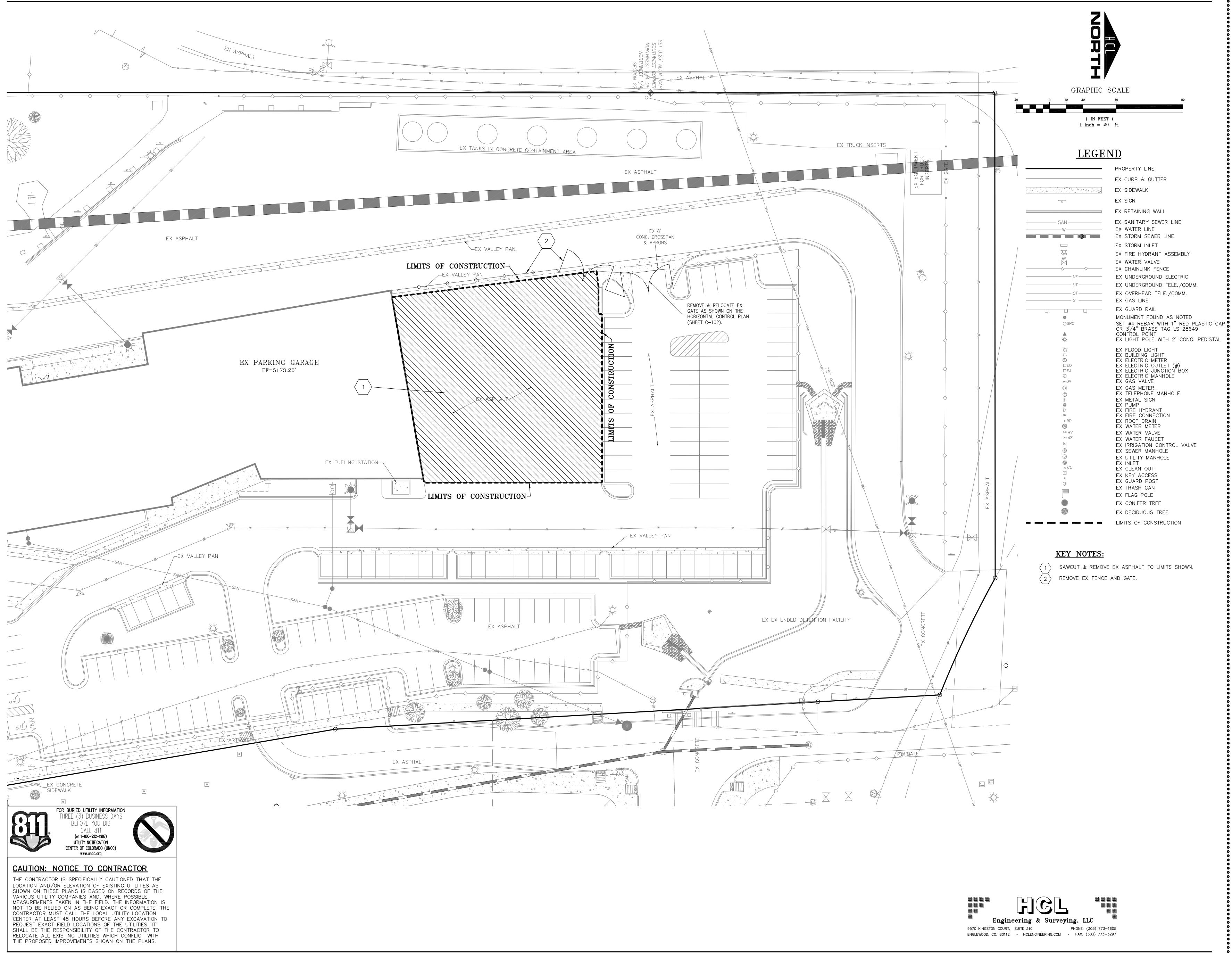
Denver Traffic **Operations Command** Vehicle Storage & Modifications 3501 Park Avenue Denver, CO 80216

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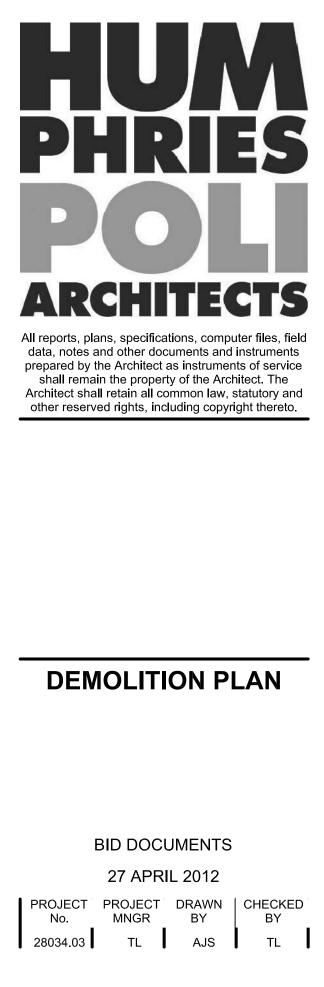
C-100





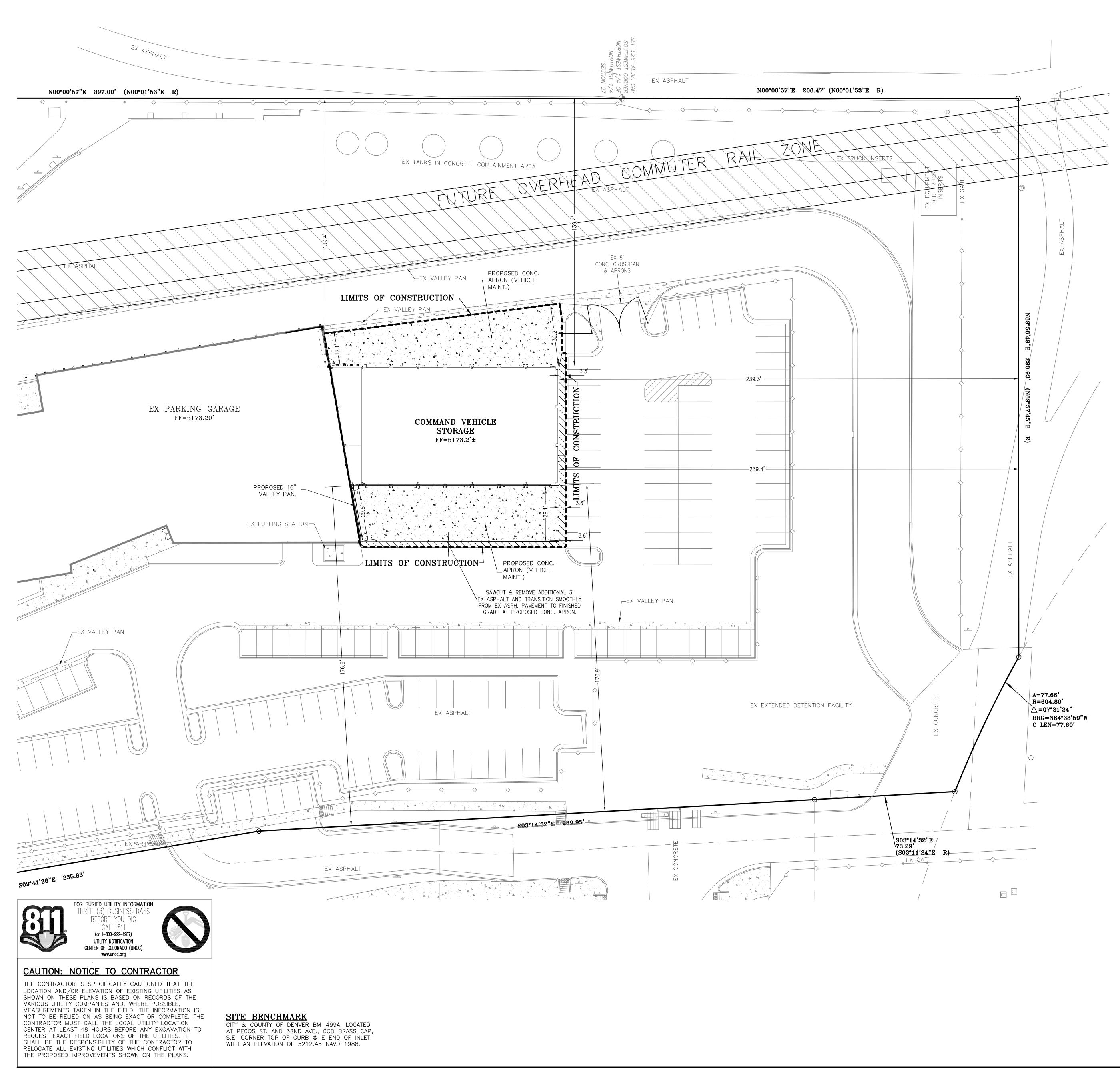
Denver Traffic **Operations Command** Vehicle Storage & Modifications 3501 Park Avenue Denver, CO 80216

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SHEET No.

C-101



GRAPHIC SCALE ( IN FEET ) 1 inch = 20 ft.<u>LEGEND</u> PROPERTY BOUNDARY CENTERLINE \_\_\_\_\_ \_ \_ \_ \_ \_ \_ \_ \_ \_ EX FENCE EX CURB & GUTTER EX SIDEWALK EX SIGN EX RETAINING WALL PROPOSED 5.5" FULL—DEPTH ASPHALT DRIVE AISLE & FIRE LANE

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## **CONTRACTOR NOTES:**

4

1) FOR PAVEMENT & COMPACTION DESIGN SEE YEH & ASSOCIATES, INC. GEOTECHNICAL ENGINEERING REPORT MARCH 26, 2009.

PROPOSED 6" PORTLAND CEMENT CONCRETE

(VEHICLE MAINT. AREA APRON)

LIMITS OF CONSTRUCTION

2) ALL DIMENSIONS ARE 90° TO PROPERTY BOUNDARY UNLESS OTHERWISE NOTED.

3) CONTRACTOR TO DO TAKEOFF FROM ARCHITECT'S FOUNDATION PLAN FOR EXACT BUILDING DIMENSIONS.

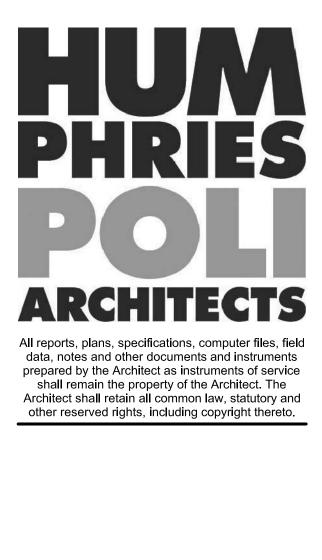
4) PROPOSED PAVING TO TIE INTO EX CONC. FLATWORK.





Denver Traffic Operations Command Vehicle Storage & Modifications 3501 Park Avenue Denver, CO 80216

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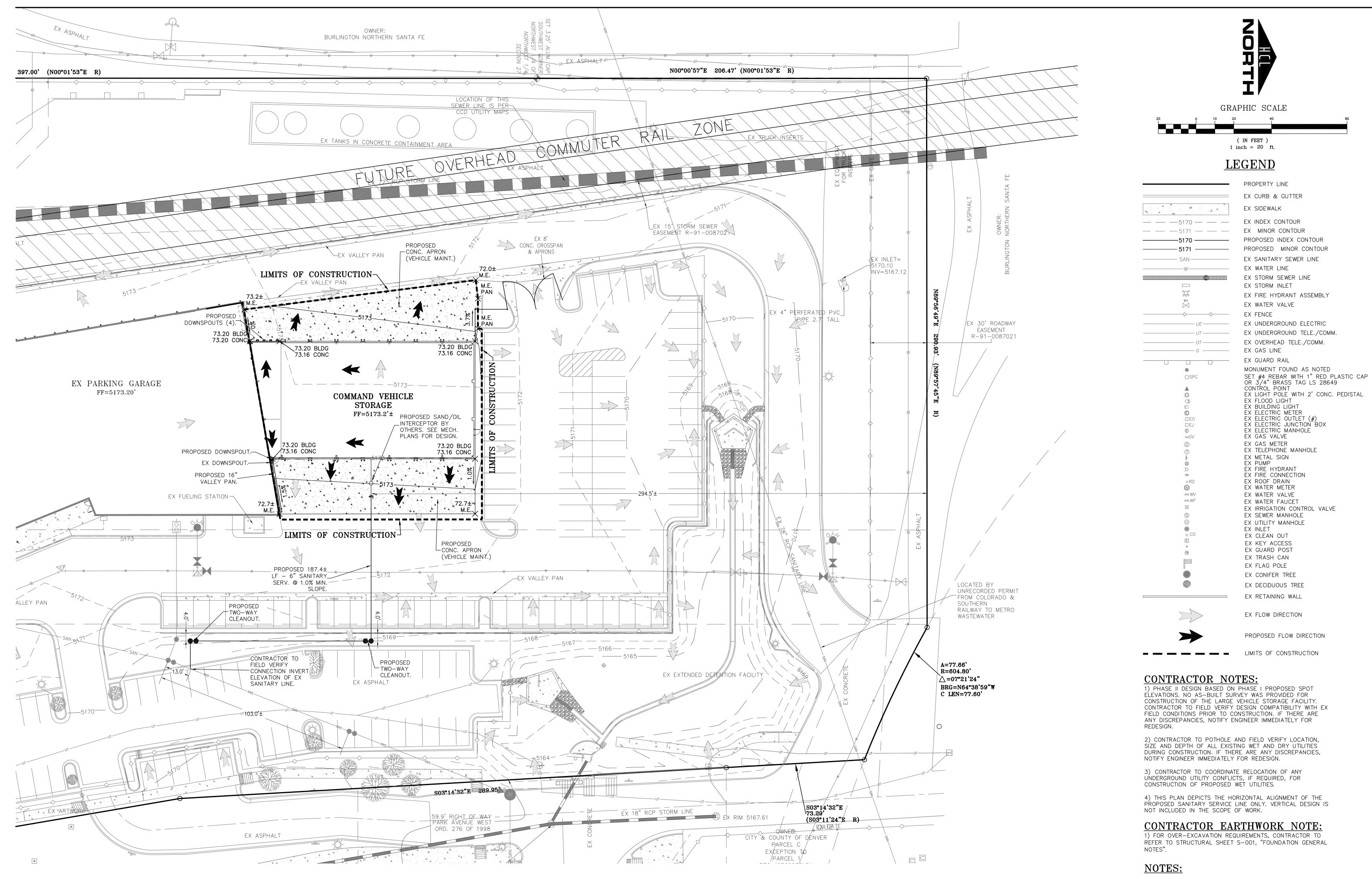
27 APRIL 2012

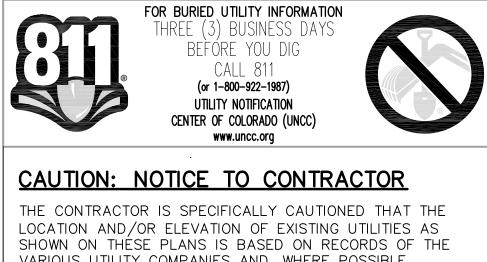
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SHEET No.

C-102





VARIOUS UTILITY COMPANIES AND, WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE LOCAL UTILITY LOCATION CENTER AT LEAST 48 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATIONS OF THE UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS.

SITE BENCHMARK

CITY & COUNTY OF DENVER BM-499A, LOCATED AT PECOS ST. AND 32ND AVE., CCD BRASS CAP, S.E. CORNER TOP OF CURB @ E END OF INLET WITH AN ELEVATION OF 5212.45 NAVD 1988.

EX TELEPHONE MANHOLE EX FIRE CONNECTION EX WATER FAUCET EX IRRIGATION CONTROL VALVE EX SEWER MANHOLE EX UTILITY MANHOLE EX CONIFER TREE

EX DECIDUOUS TREE EX RETAINING WALL

EX FLOW DIRECTION

PROPOSED FLOW DIRECTION

LIMITS OF CONSTRUCTION

ÉLEVATIONS. NO AS-BUILT SURVEY WAS PROVIDED FOR CONSTRUCTION OF THE LARGE VEHICLE STORAGE FACILITY. CONTRACTOR TO FIELD VERIFY DESIGN COMPATIBILITY WITH EX FIELD CONDITIONS PRIOR TO CONSTRUCTION. IF THERE ARE ANY DISCREPANCIES, NOTIFY ENGINEER IMMEDIATELY FOR

2) CONTRACTOR TO POTHOLE AND FIELD VERIFY LOCATION, SÍZE AND DEPTH OF ALL EXISTING WET AND DRY UTILITIES DURING CONSTRUCTION. IF THERE ARE ANY DISCREPANCIES,

3) CONTRACTOR TO COORDINATE RELOCATION OF ANY UNDERGROUND UTILITY CONFLICTS, IF REQUIRED, FOR

4) THIS PLAN DEPICTS THE HORIZONTAL ALIGNMENT OF THE PROPOSED SANITARY SERVICE LINE ONLY. VERTICAL DESIGN IS

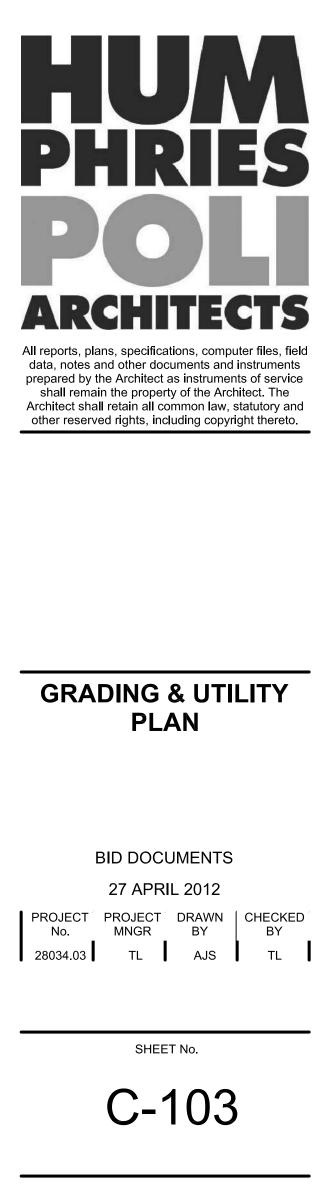
## **CONTRACTOR EARTHWORK NOTE:** 1) FOR OVER-EXCAVATION REQUIREMENTS, CONTRACTOR TO REFER TO STRUCTURAL SHEET S-001, "FOUNDATION GENERAL

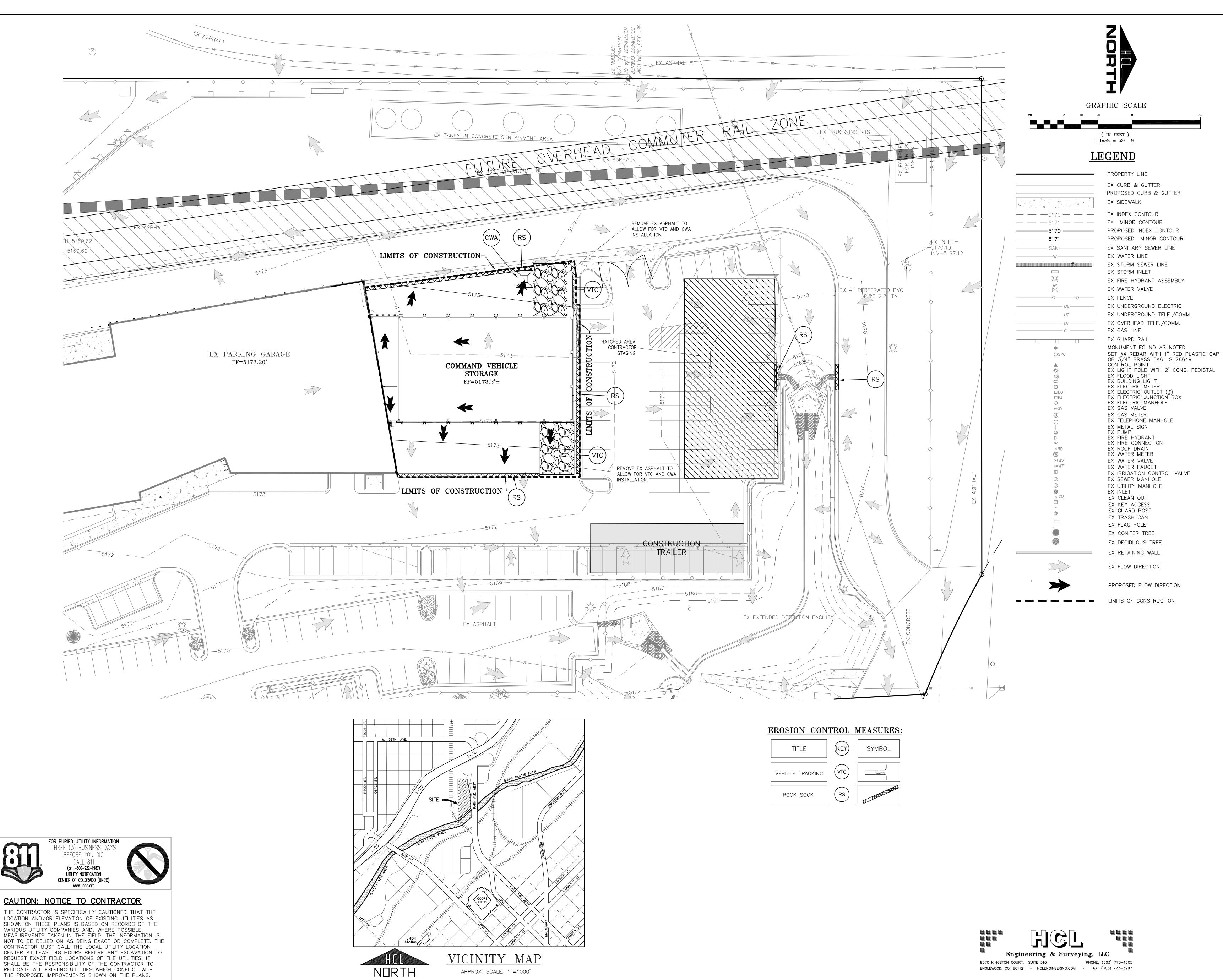
BLDG=BUILDING CONC=CONCRETE M.E.=MATCH EXISTING G.B.=GRADE BREAK PAN=CONC. GUTTER PAN





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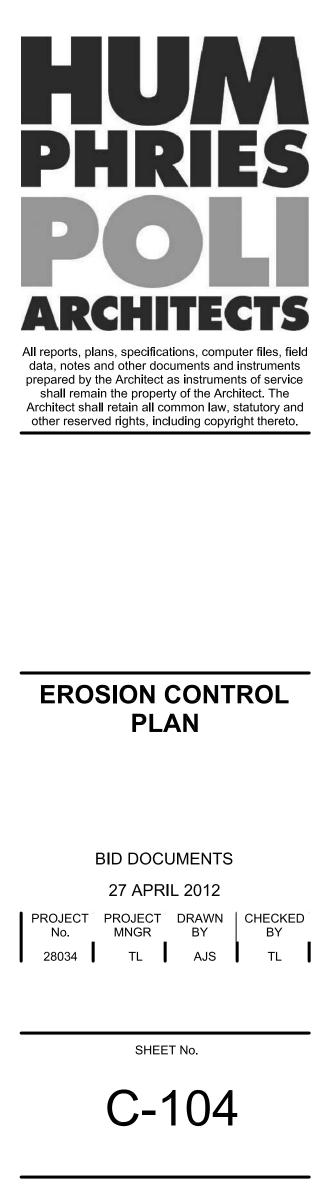


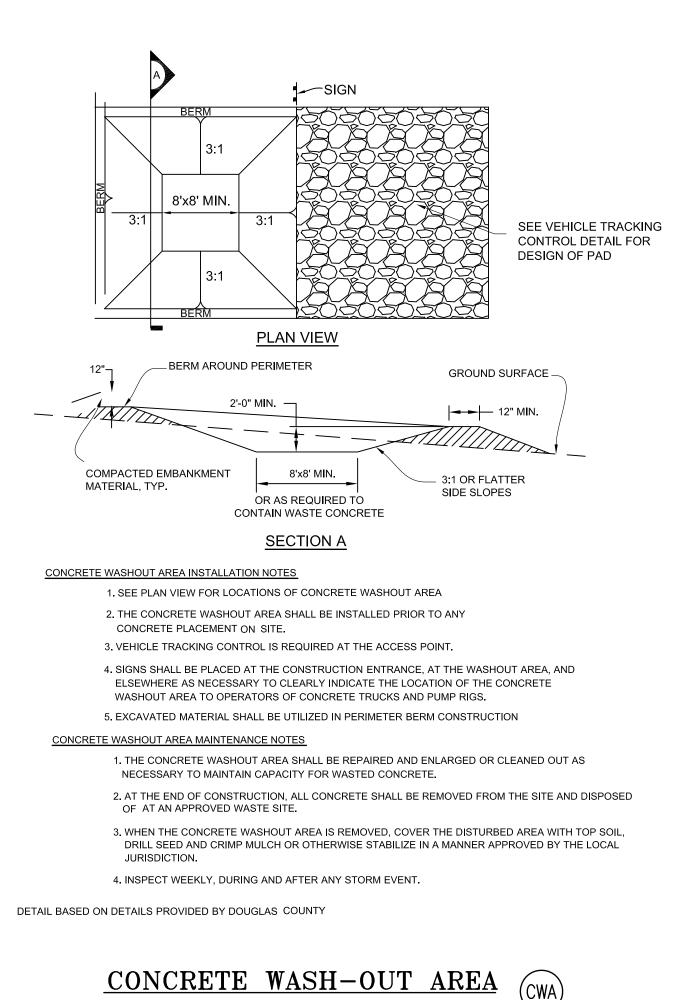


| .E      | KEY | SYMBOL |
|---------|-----|--------|
| RACKING | VTC |        |
| SOCK    | RS  |        |

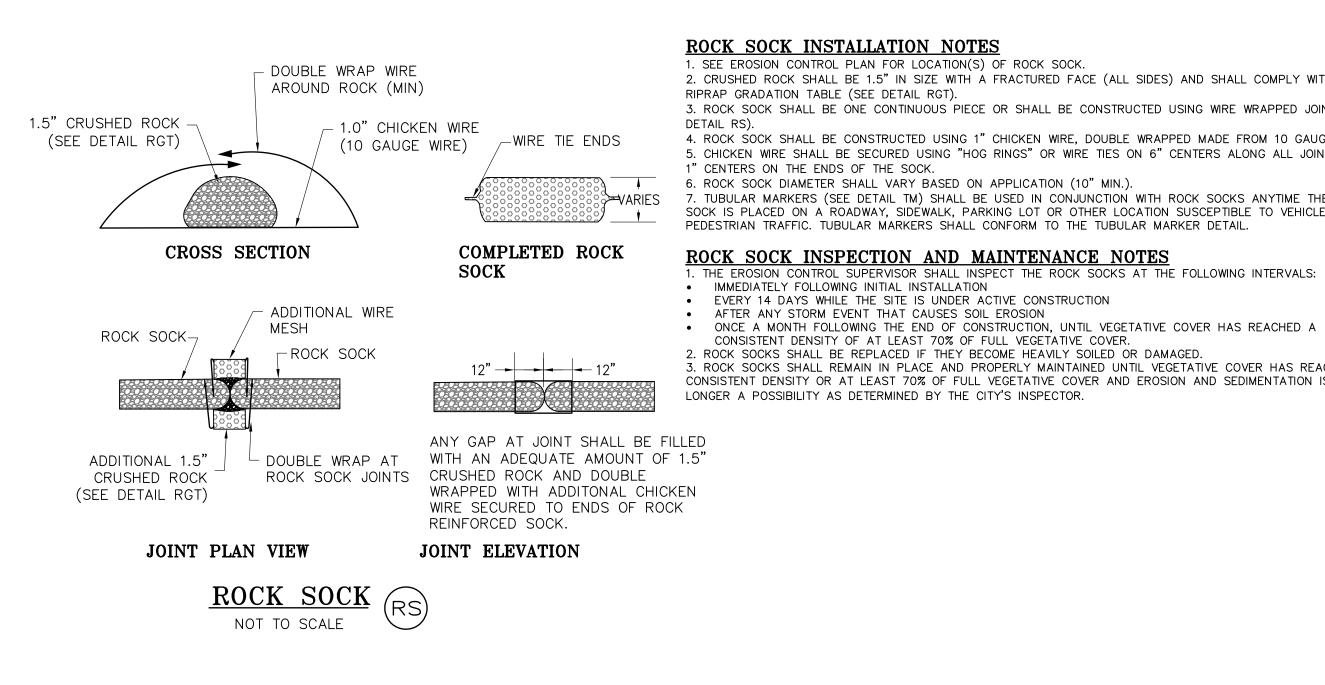


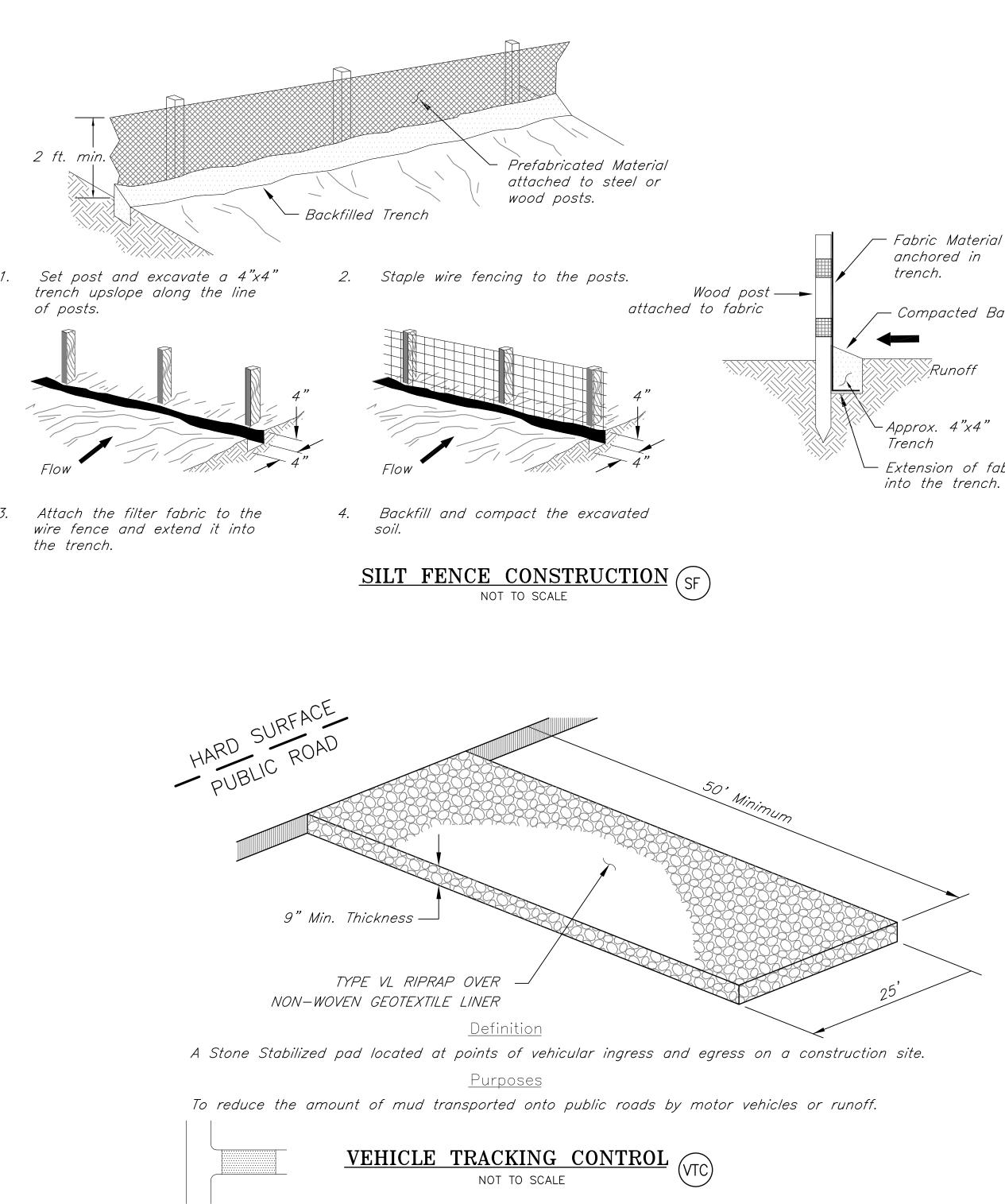
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NOT TO SCALE





2. CRUSHED ROCK SHALL BE 1.5" IN SIZE WITH A FRACTURED FACE (ALL SIDES) AND SHALL COMPLY WITH THE 3. ROCK SOCK SHALL BE ONE CONTINUOUS PIECE OR SHALL BE CONSTRUCTED USING WIRE WRAPPED JOINTS (SEE

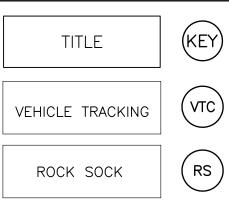
4. ROCK SOCK SHALL BE CONSTRUCTED USING 1" CHICKEN WIRE, DOUBLE WRAPPED MADE FROM 10 GAUGE WIRE. 5. CHICKEN WIRE SHALL BE SECURED USING "HOG RINGS" OR WIRE TIES ON 6" CENTERS ALONG ALL JOINTS AND

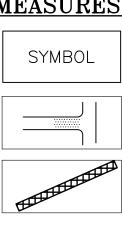
7. TUBULAR MARKERS (SEE DETAIL TM) SHALL BE USED IN CONJUNCTION WITH ROCK SOCKS ANYTIME THE ROCK SOCK IS PLACED ON A ROADWAY, SIDEWALK, PARKING LOT OR OTHER LOCATION SUSCEPTIBLE TO VEHICLE OR

### ROCK SOCK INSPECTION AND MAINTENANCE NOTES THE EROSION CONTROL SUPERVISOR SHALL INSPECT THE ROCK SOCKS AT THE FOLLOWING INTERVALS:

3. ROCK SOCKS SHALL REMAIN IN PLACE AND PROPERLY MAINTAINED UNTIL VEGETATIVE COVER HAS REACHED A CONSISTENT DENSITY OR AT LEAST 70% OF FULL VEGETATIVE COVER AND EROSION AND SEDIMENTATION IS NO

## **EROSION CONTROL MEASURES:**





## STANDARD NOTES FOR WATER QUALITY/NPDES, EROSION & SEDIMENT CONTROL

Compacted Backfill

- Extension of fabric and

pollutants that may have been discharged to or, accumulate in, the flowlines, storm drainage appurtenances, and public rights of ways of the City and County of Denver as a result of construction activities associated with this site development or construction project. Said removal shall be conducted in a timely manner."

STANDARD NOTE # 1 "The Permittee and/or Contractor shall remove all sediment, mud, construction debris, or other potential

STANDARD NOTE # 2

"The Contractor shall prevent sediment, debris and all other pollutants from entering the storm sewer system during all demolition, excavation, trenching, boring, grading, or other construction operations that are part of this project. The Contractor shall be held responsible for remediation of any adverse impacts to the Municipal Separate Storm Sewer System, receiving waters, waterways, wetlands, and or other public or private properties, resulting from work done as part of this project."

STANDARD NOTE # 3 "Soil stabilization measures shall be implemented within fourteen (14) days following completion of grading activities. Stabilization of disturbed areas adjacent to receiving waters or with slopes 3 to 1 or greater shall be completed within seven (7) days following completion of grading activities. Note: Federal and State regulations may soon require stabilization within seven (7) days of completion of grading activities. In such cases, the shorter timeframe shall apply to projects within Denver as well."

STANDARD NOTE # 4 "The Developer, GeneralContractor, Grading Contractor and/or their authorized agents shall insure that all loads of cut and fill material imported to or exported from this site shall be properly covered to prevent loss of the material during transport on public rights of way." (Sec.49-552; Revised Municipal Code)

STANDARD NOTE # 5 "The use of rebar to anchor best management practices is prohibited." Steel fence posts may be used on a case by case basis and requires approval from the City and County of Denver SWMP reviewer or the stormwater enforcement investigator prior to installation."

## STANDARD NOTE # 6

"Soils that will be stockpiled for more than thirty (30) days shall be protected from wind and water erosion within fourteen (14) days of stockpile construction. Stabilization of stockpiles located within 100 feet of receiving waters, or with slopes 3 to 1 or greater shall be completed within seven (7) days following stockpile construction. Stabilization and protection of the stockpile may be accomplished by any of the following: Mulching, Temporary/Permanent Revegetation Operations, Chemical Soil Stabilizer Application (requires Denver Public Works approval), or erosion control matting/Geotextiles. If stockpiles are located within 100 feet of receiving waters, a drainageway or the site perimeter, additional sediment controls such shall be required."

### STANDARD NOTE # 7

"Approved erosion and sediment control 'Best Management Practices' shall be maintained and kept in good repair for the duration of this project. At a minimum, the Permittee or contractor shall produce and retain weekly written inspection records for all BMPs and after significant precipitation events. All necessary maintenance and repair shall be completed immediately. Additionally, street sweeping is to be completed by the close of the business day or (and) on an as needed basis throughout the day.

### <u>STANDARD NOTE # 8</u>

"Water used in the cleaning of cement truck delivery chutes shall be discharged into a predefined, concrete washout area on the job site. Bermed containment or commercially available concrete washout devices that fully contain all wash water are acceptable. Wash water discharged into the containment area or device shall be allowed to infiltrate, evaporate, and or be disposed of in accordance with all applicable regulations. Dried cement waste is to be removed from the containment area and properly disposed.

Should the use of a predefined bermed containment area or approved washout device be technically infeasible due to the project size, or lack of an area with a suitable ground surface for establishing containment, proper disposal of concrete washout and wash water at the job site shall conform to the approved techniques and practices identified in the Colorado Department of Public Health & Environment's training video entitled 'Building For a Cleaner Environment, Ready Mix Washout Training' and its accompanying manual entitled, 'Ready Mix Washout Guidebook, Vehicle and Equipment Washout at Construction Sites.'

The direct or indirect discharge of water containing waste cement to the storm sewer system is prohibited." (Sec.56a, c; Revised Municipal Code, City and County of Denver).

### <u>STANDARD NOTE # 9</u>

"The Contractor shall protect all storm sewer facilities adjacent to any location where pavement cutting operations involving wheel cutting, saw cutting, or abrasive water jet cutting are to take place. The Contractor shall remove and properly dispose of all waste products generated by said cutting operations on a daily basis or as

The discharge of any water contaminated by waste products from cutting operations to the storm sewer system is prohibited." (Sec.56—102a, c; Revised Municipal Code, City and County of Denver)

### <u>STANDARD NOTE # 10</u>

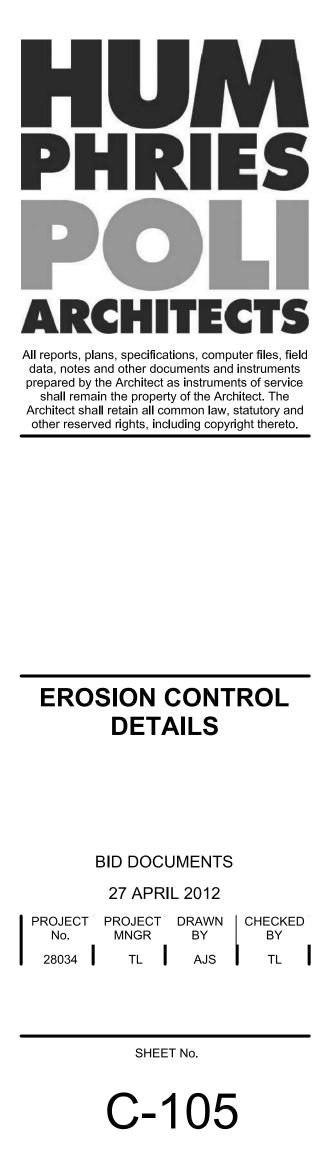
needed throughout the work day."

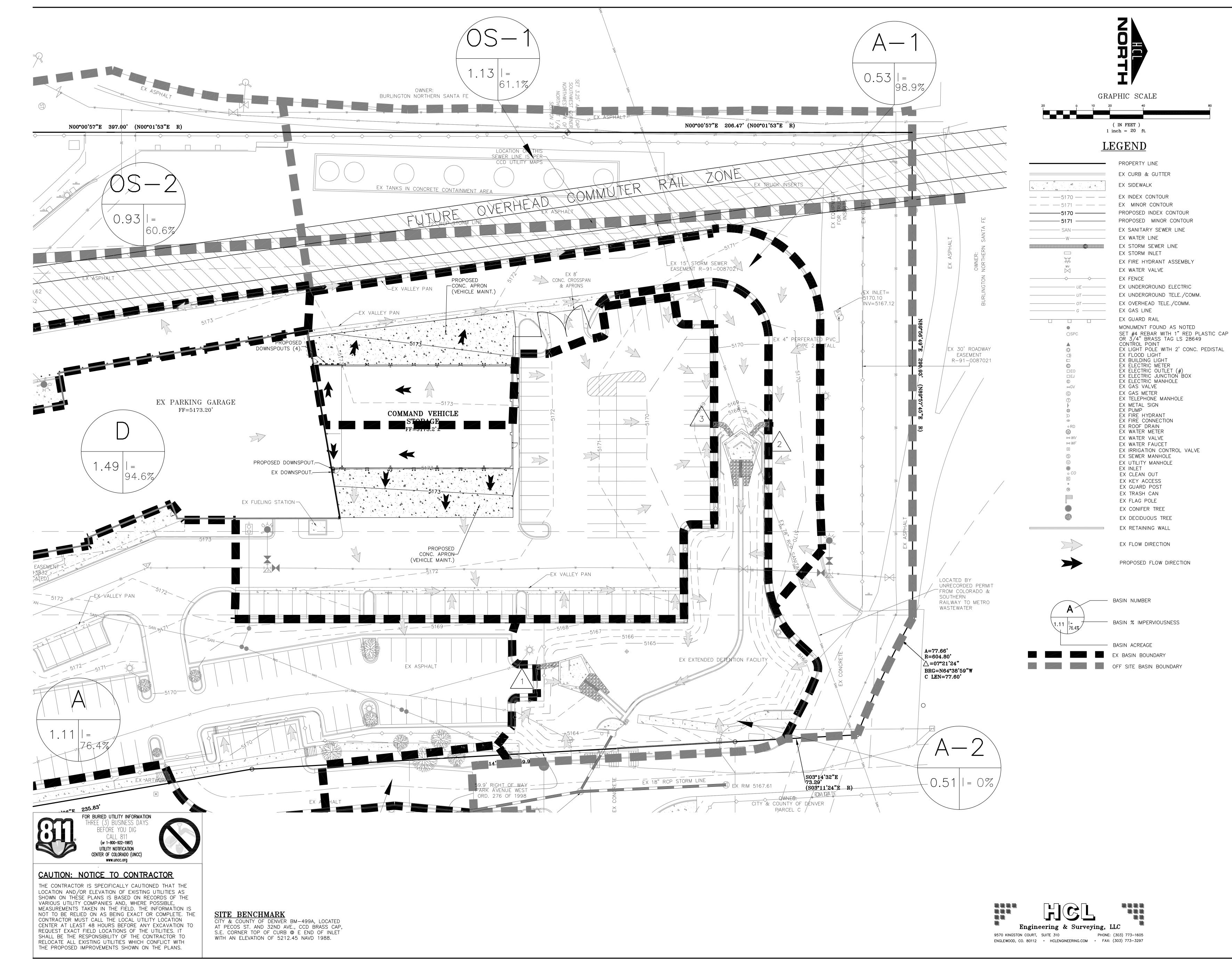
"Paved and impervious surfaces which are adjacent to construction sites must be swept on a daily basis and as needed during the day when sediment and other materials are tracked or discharged onto them. Either sweeping by hand or use of Street Sweepers is acceptable. Street sweepers using water while sweeping is preferred in order to minimize dust. Flushing off paved surfaces with water is prohibited." (Sec.56—102a, c; Revised Municipal Code, City and County of Denver)





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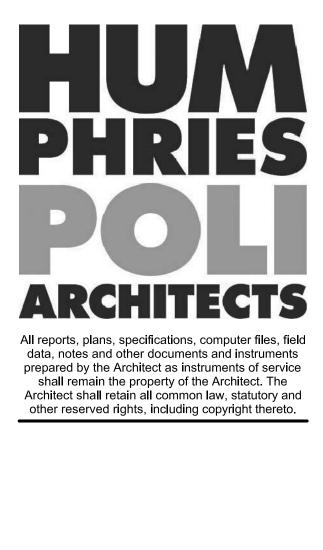






Denver Traffic **Operations Command** Vehicle Storage & Modifications 3501 Park Avenue Denver, CO 80216

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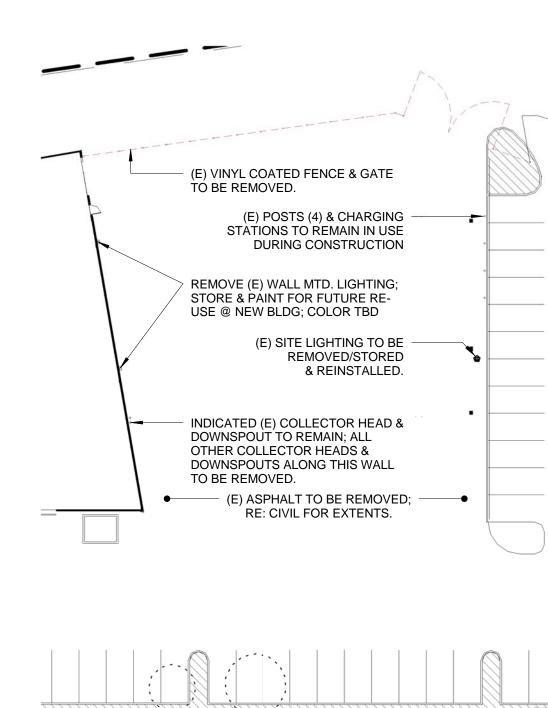




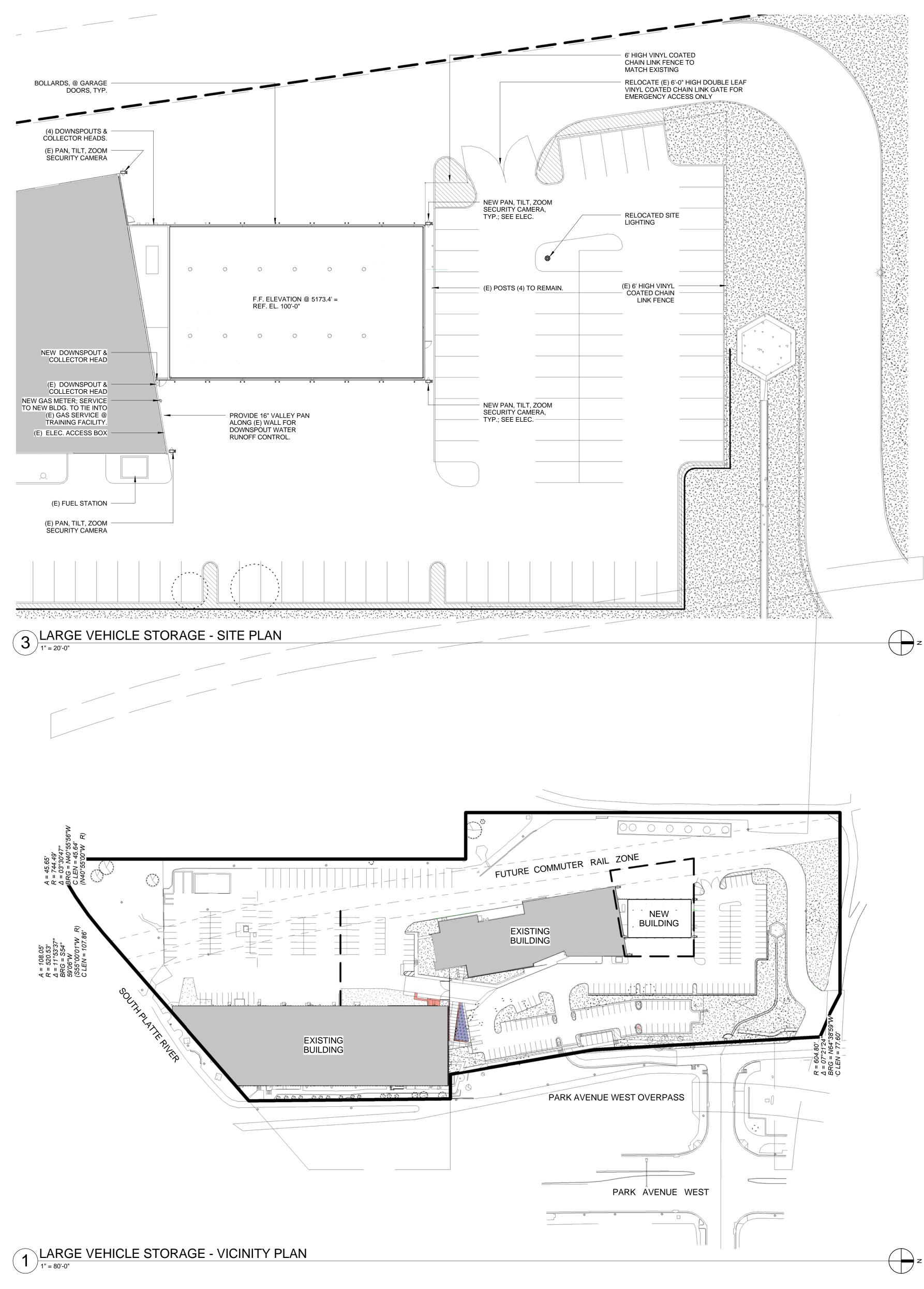


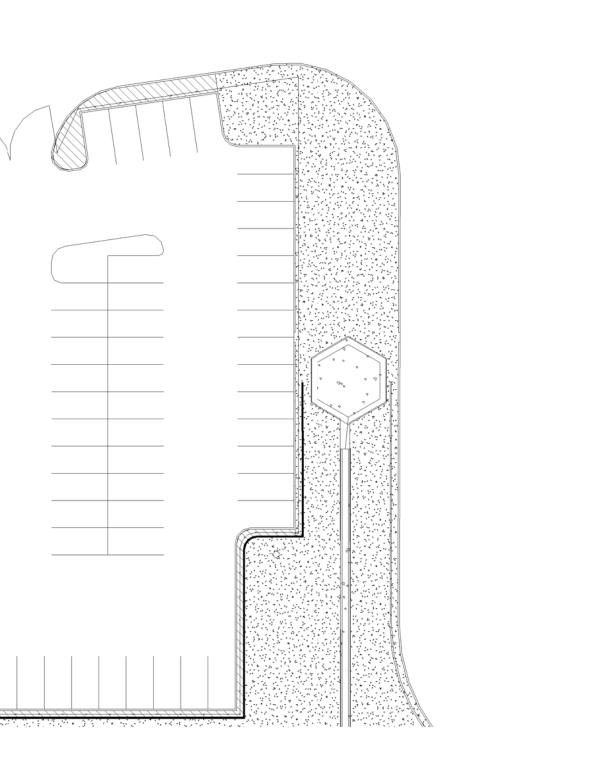
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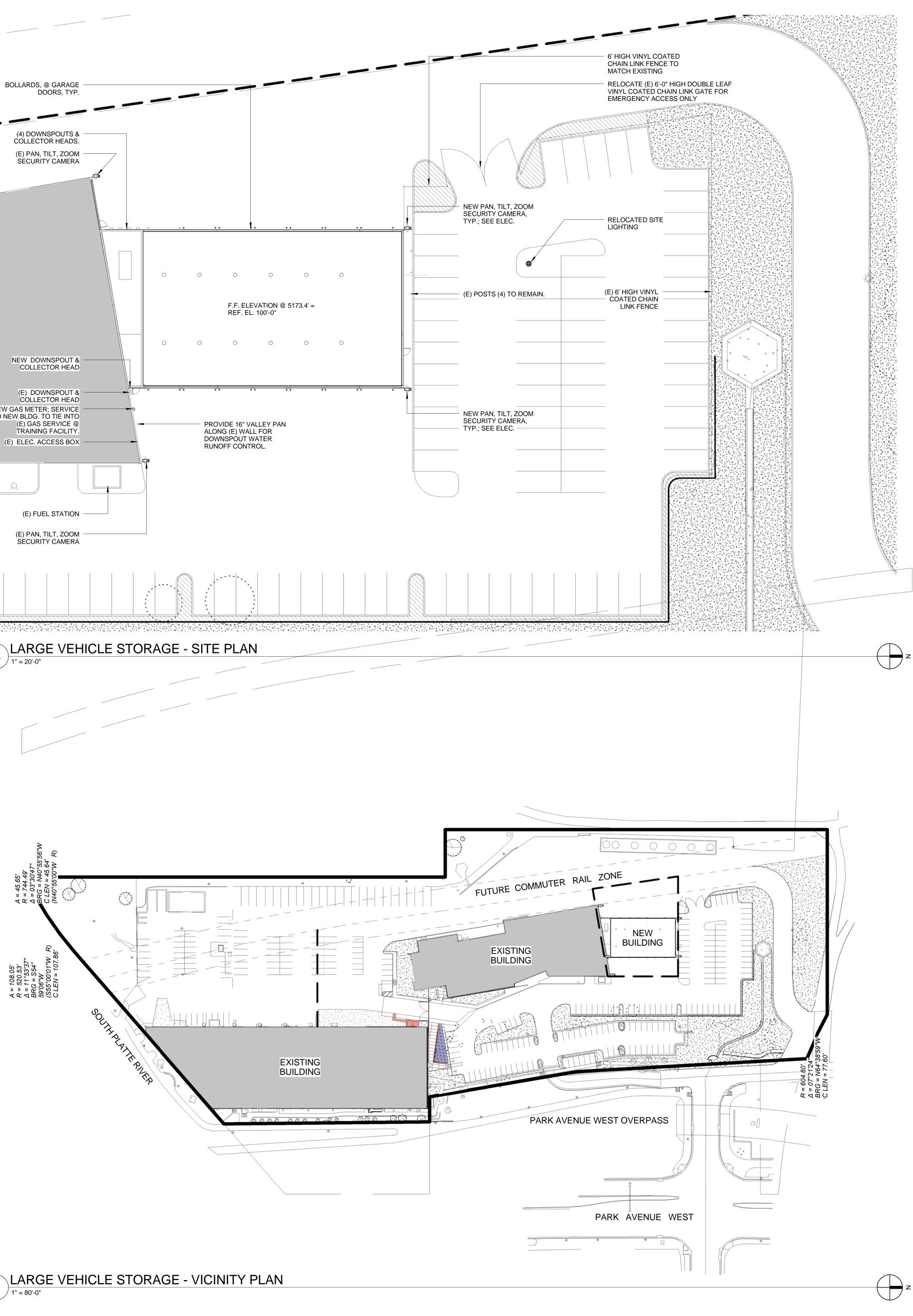


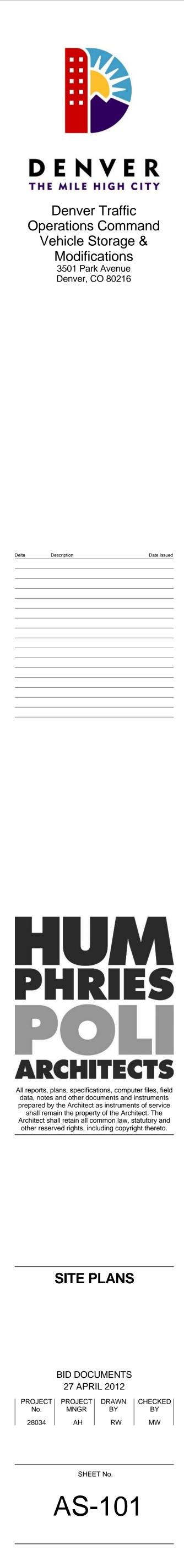
2 LARGE VEHICLE STORAGE - DEMO SITE PLAN 1" = 30'-0"

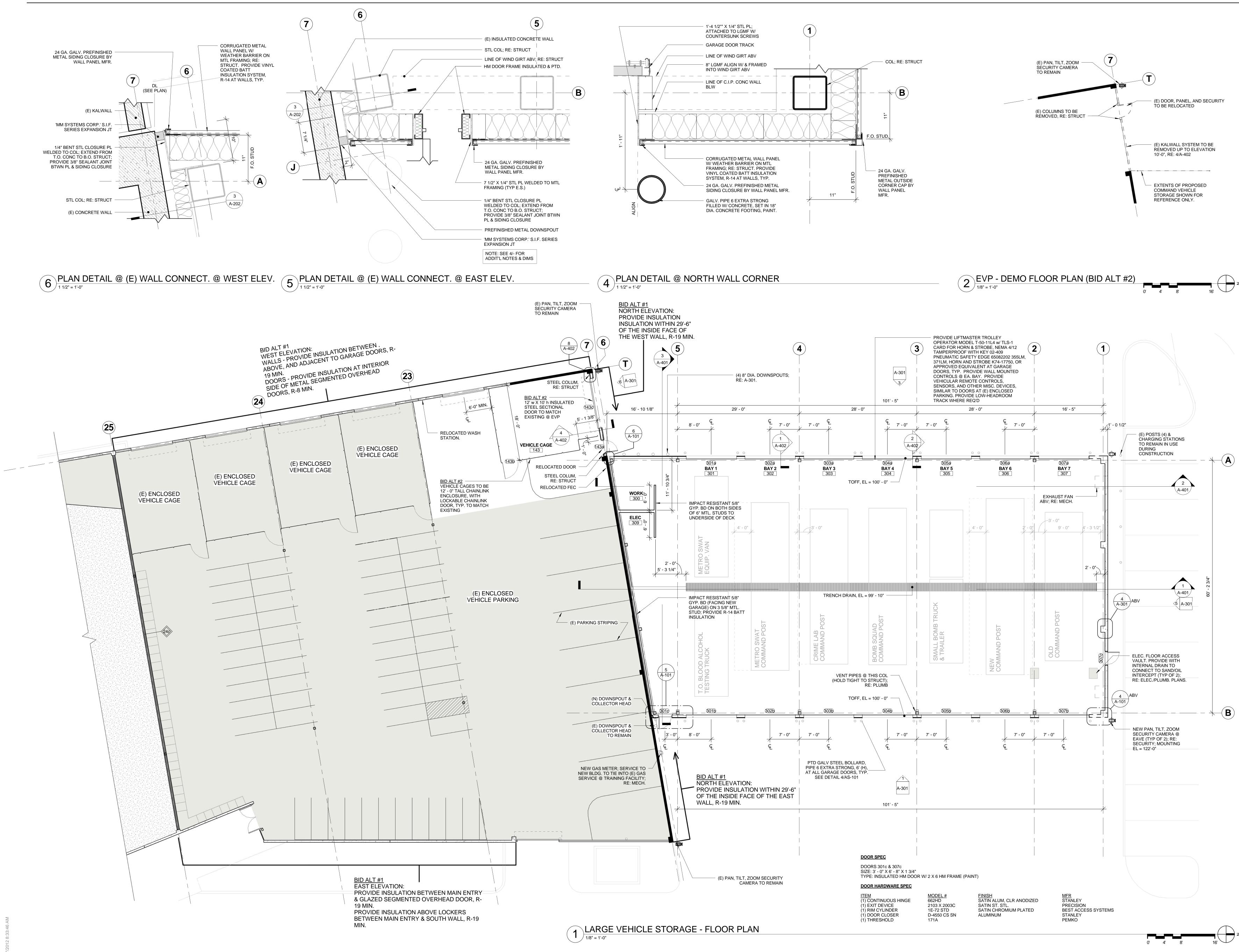




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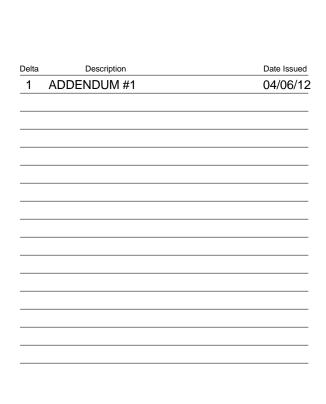




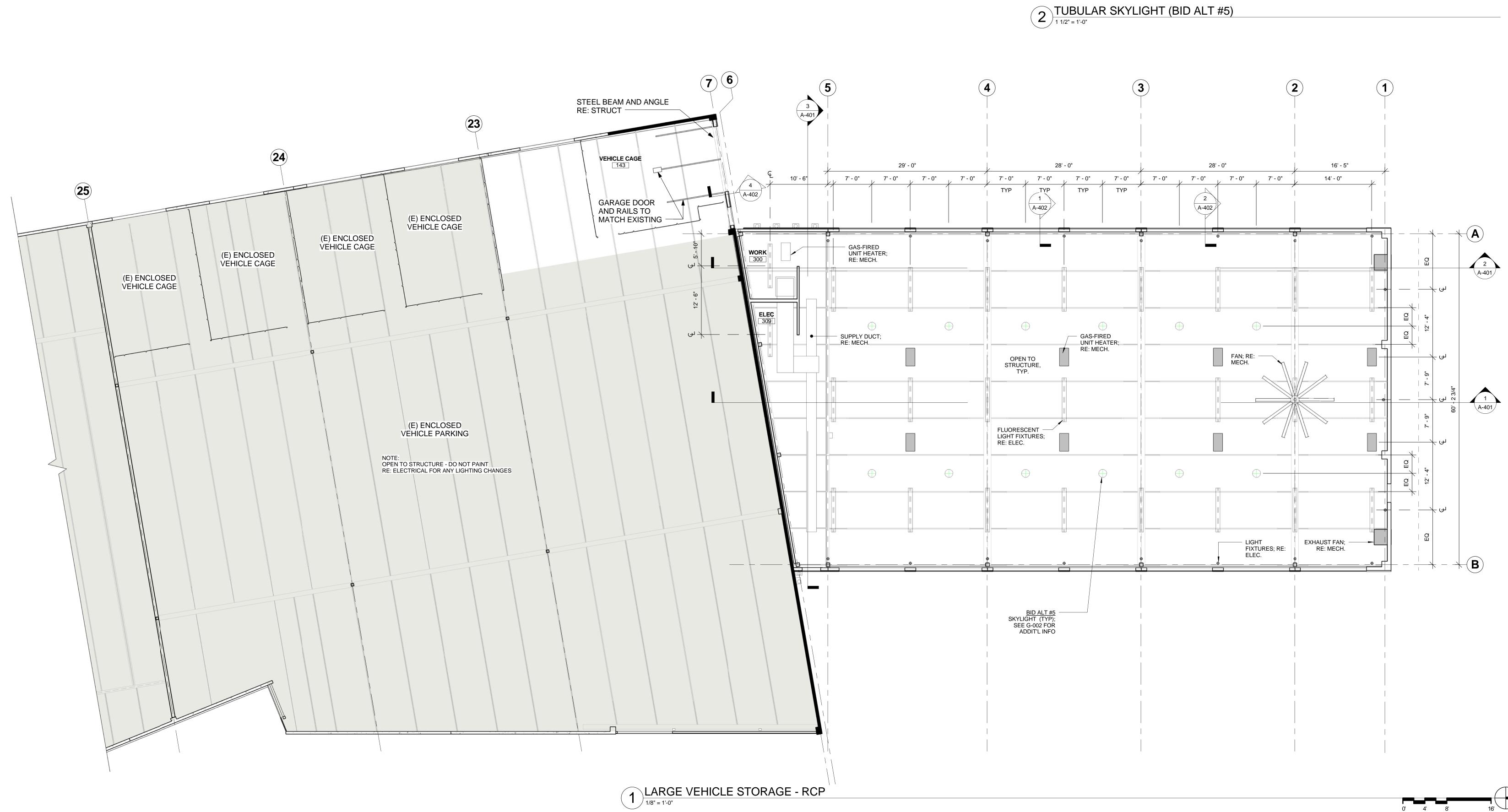


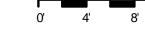


3501 Park Avenue Denver, CO 80216

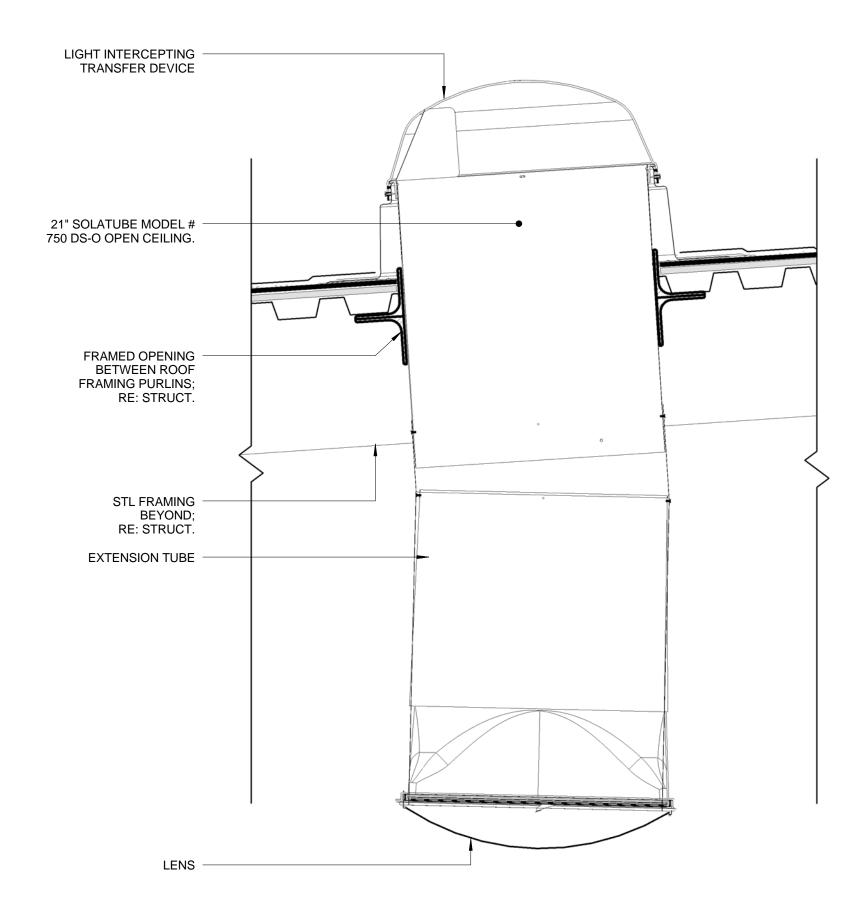




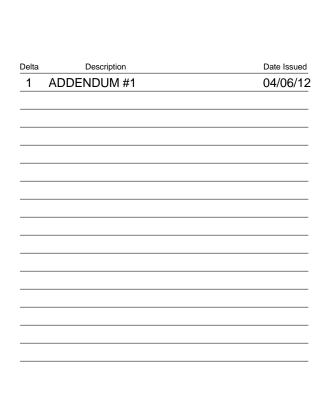


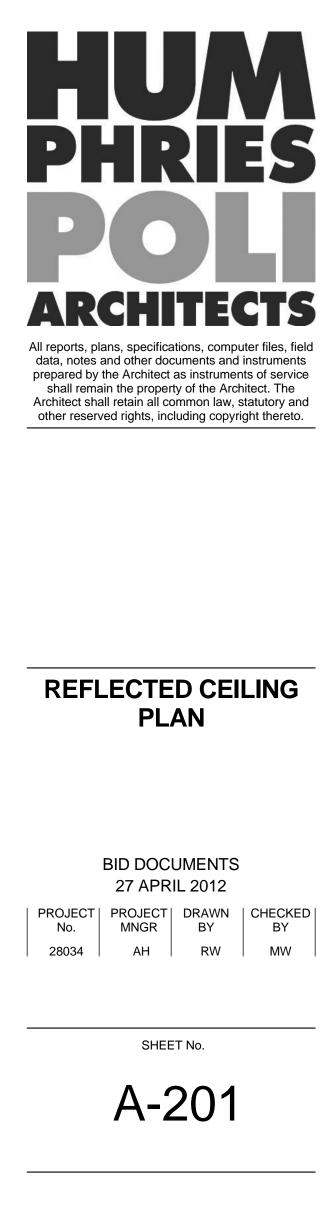


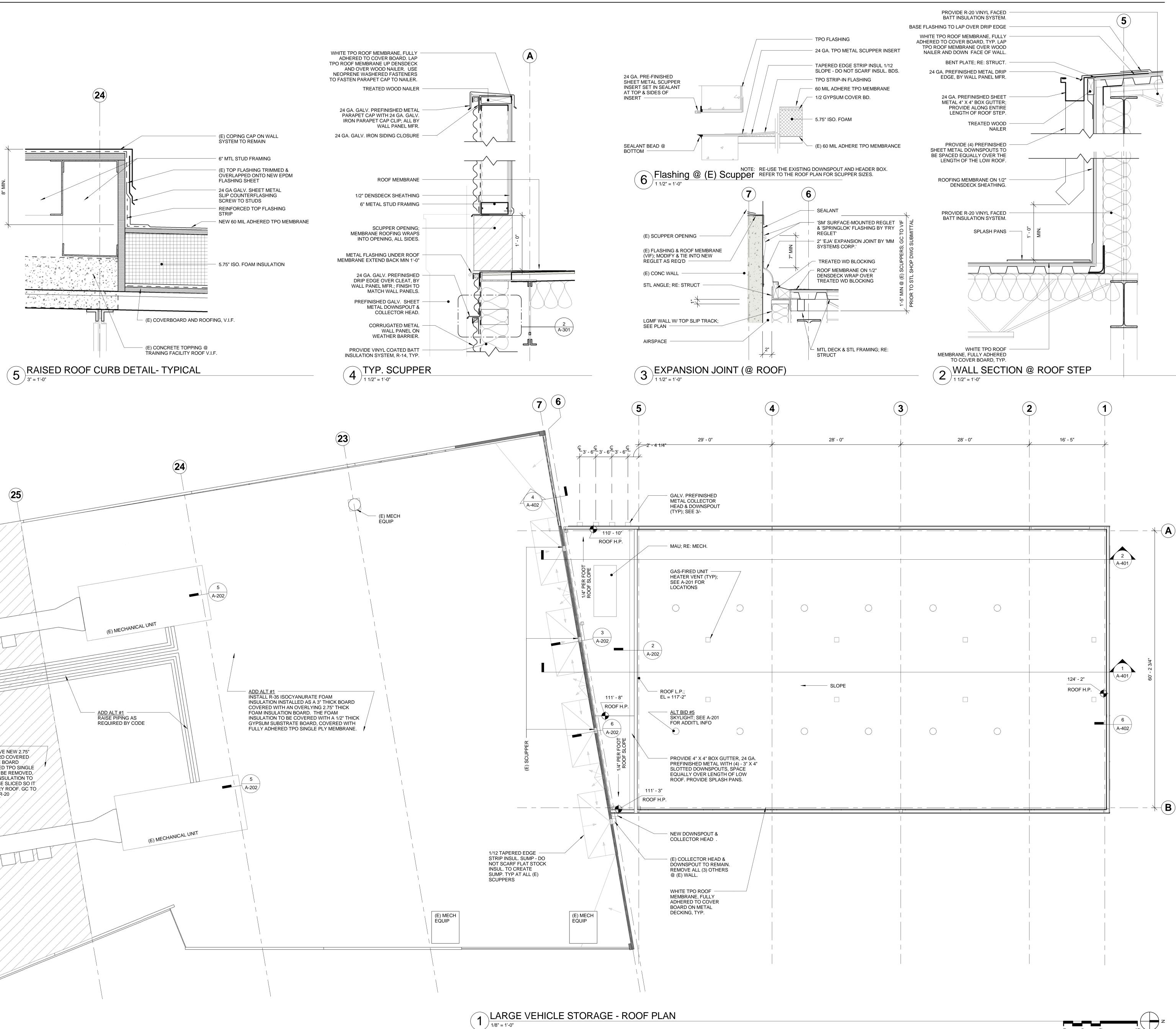


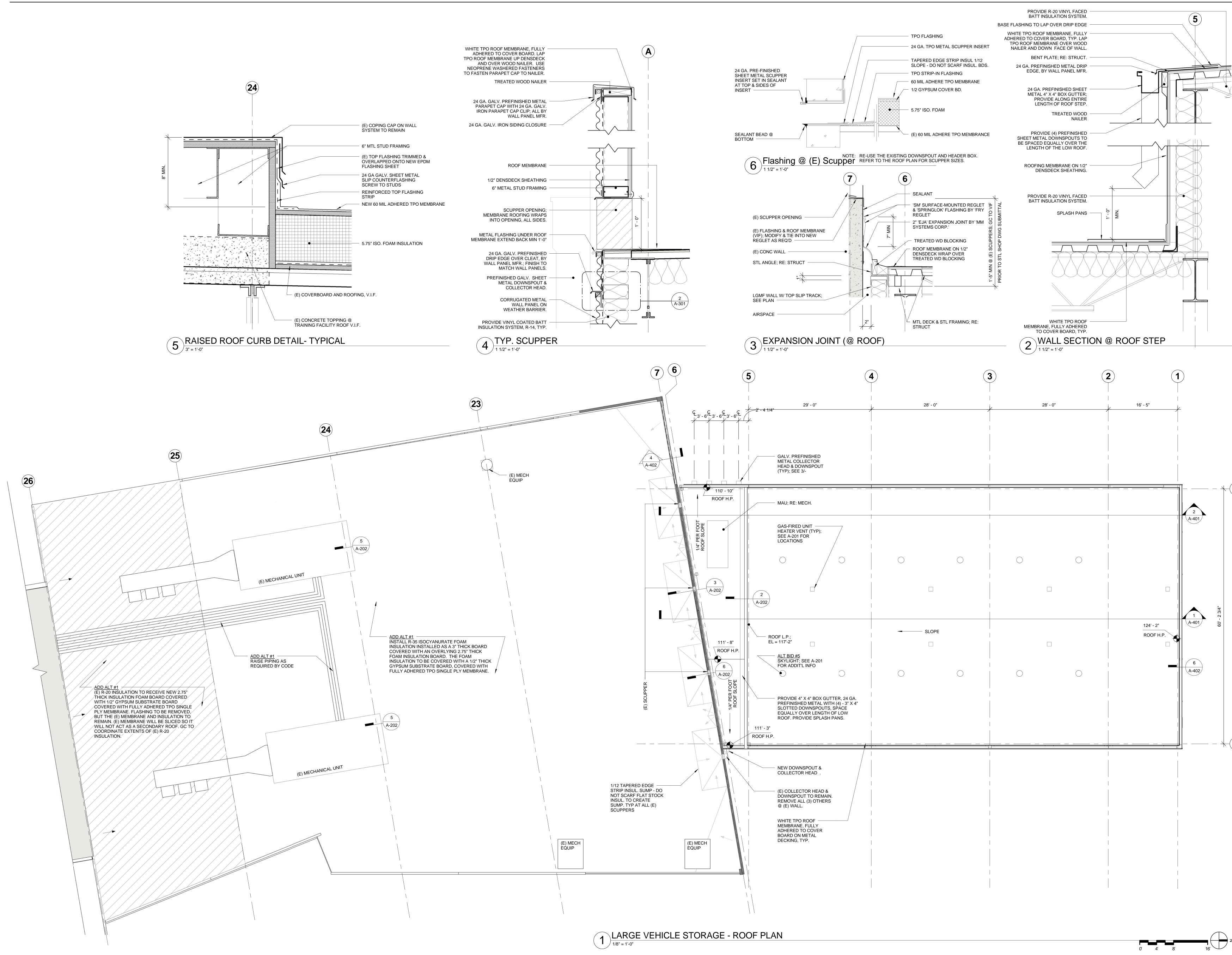








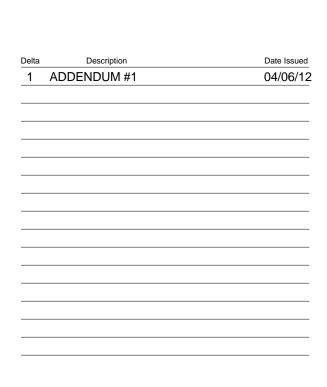




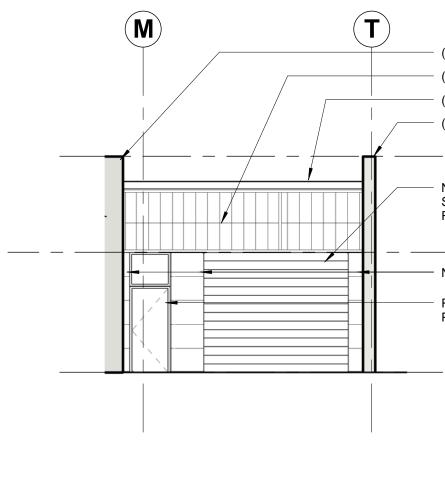


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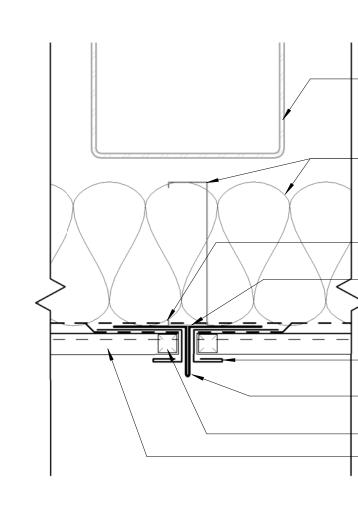
Denver, CO 80216



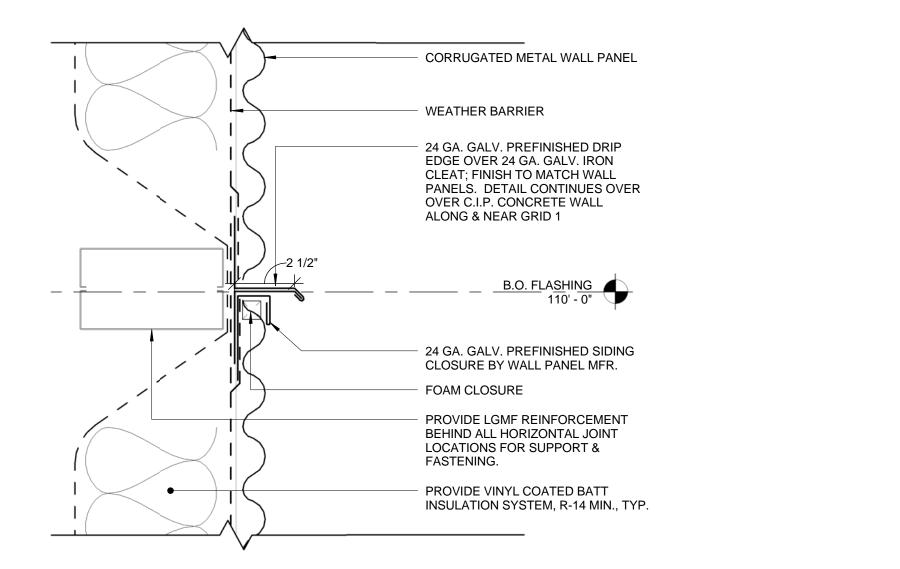






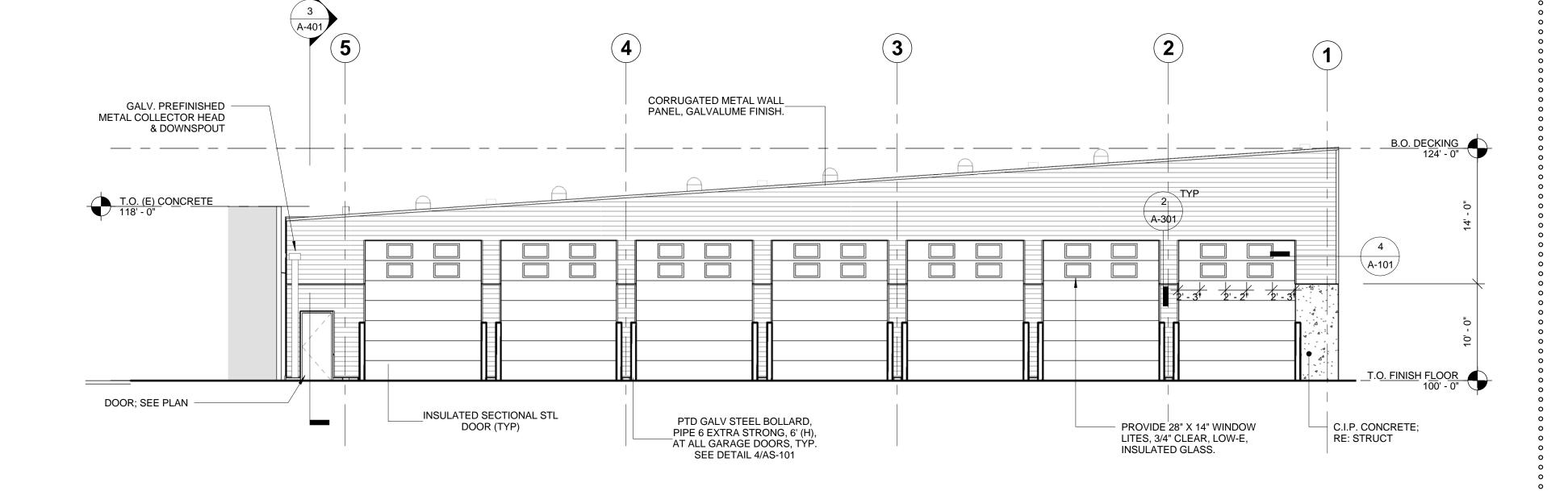


4 METAL PANEL VERT. JOINT

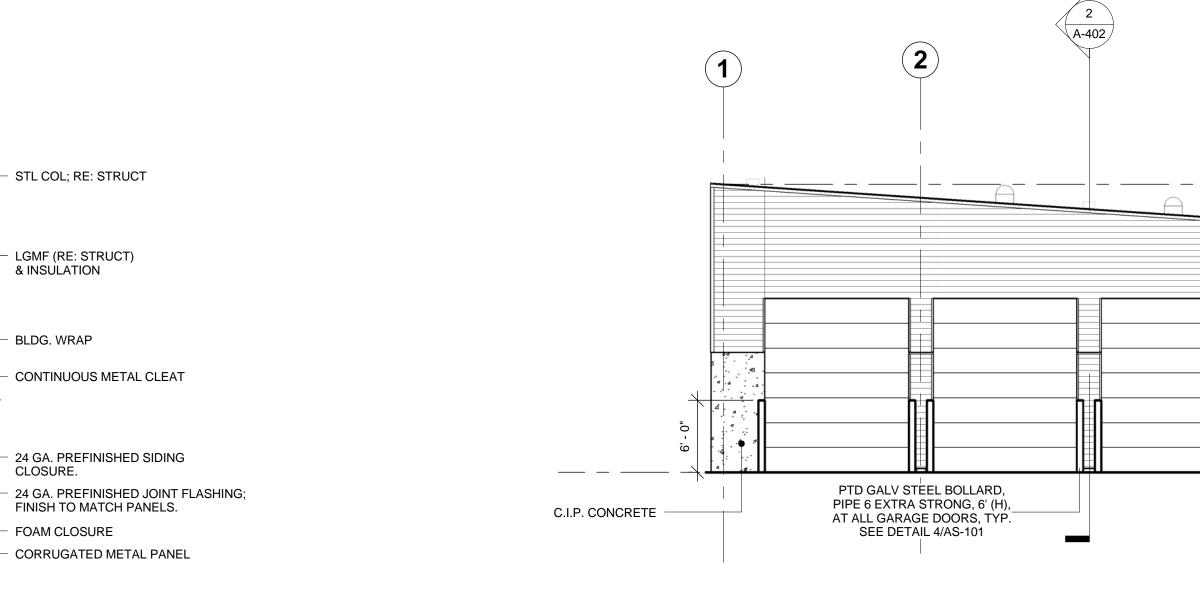


2 METAL PANEL HORIZ. JOINT

# 1 LARGE VEHICLE STORAGE - EAST ELEVATION



# 3 LARGE VEHICLE STORAGE - WEST ELEVATION



# 5 LARGE VEHICLE STORAGE - NORTH ELEVATION

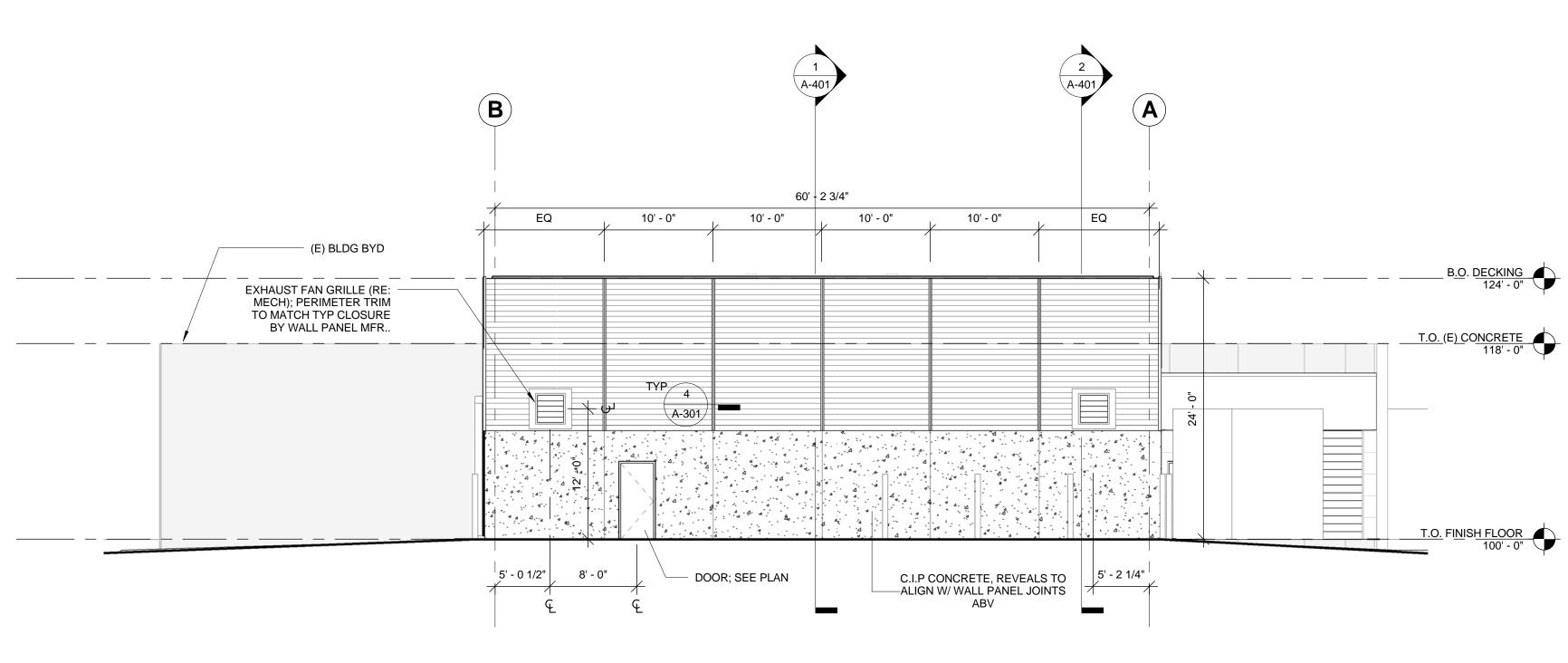
 RELOCATED (E) DOOR &
 PANEL ABOVE; RE: PLANS 

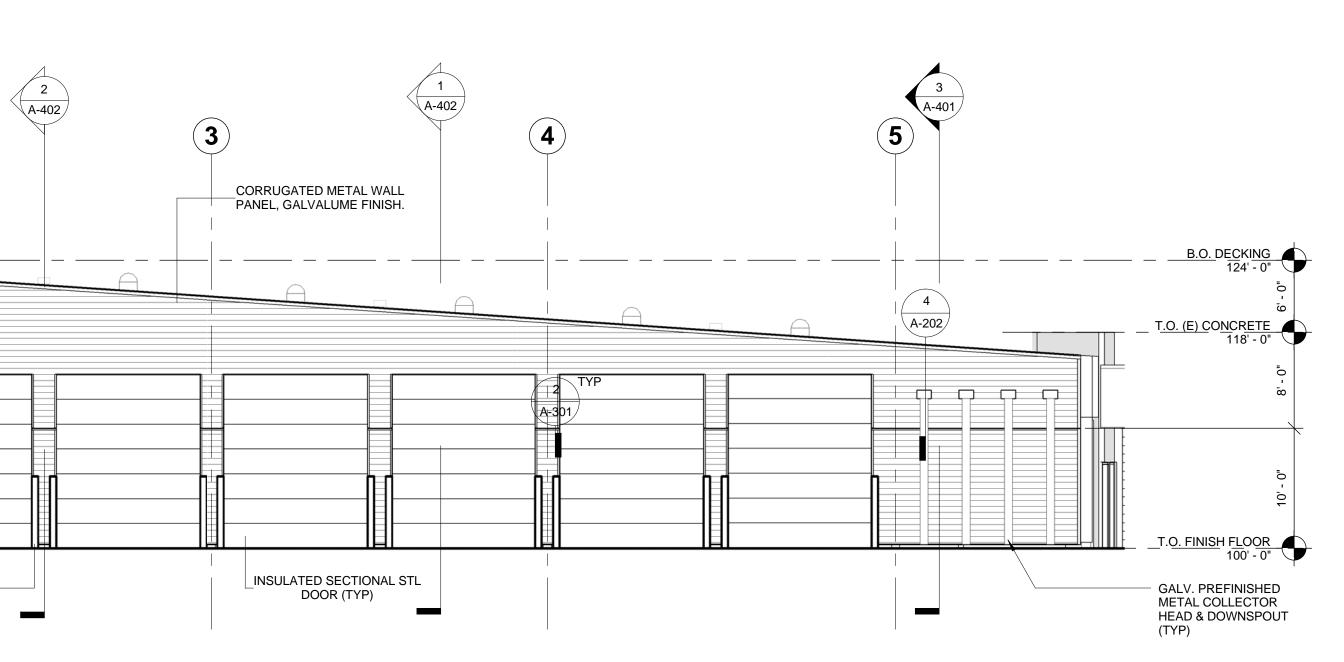
- NEW BREAK METAL WALL

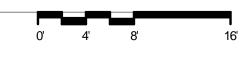
 NEW 12' w x 10' h INSULATED STEEL
 SECTION DOORGARAGE DOOR; RE: PLANS ELEV DATUM 110' - 0"

(E) WALL <u>T.O. (E)</u> C<u>ONCRETE</u> 118' - 0"

(E) WALL (E) TRANSLUCENT WALL (E) PARAPET TO BE REUSED



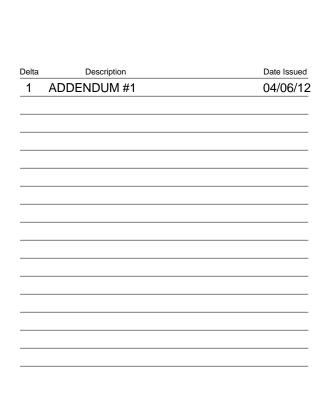




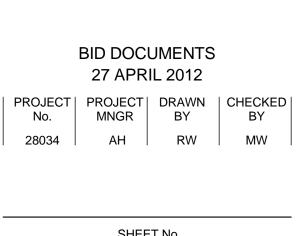
0' 4' 8'

0' 4' 8'

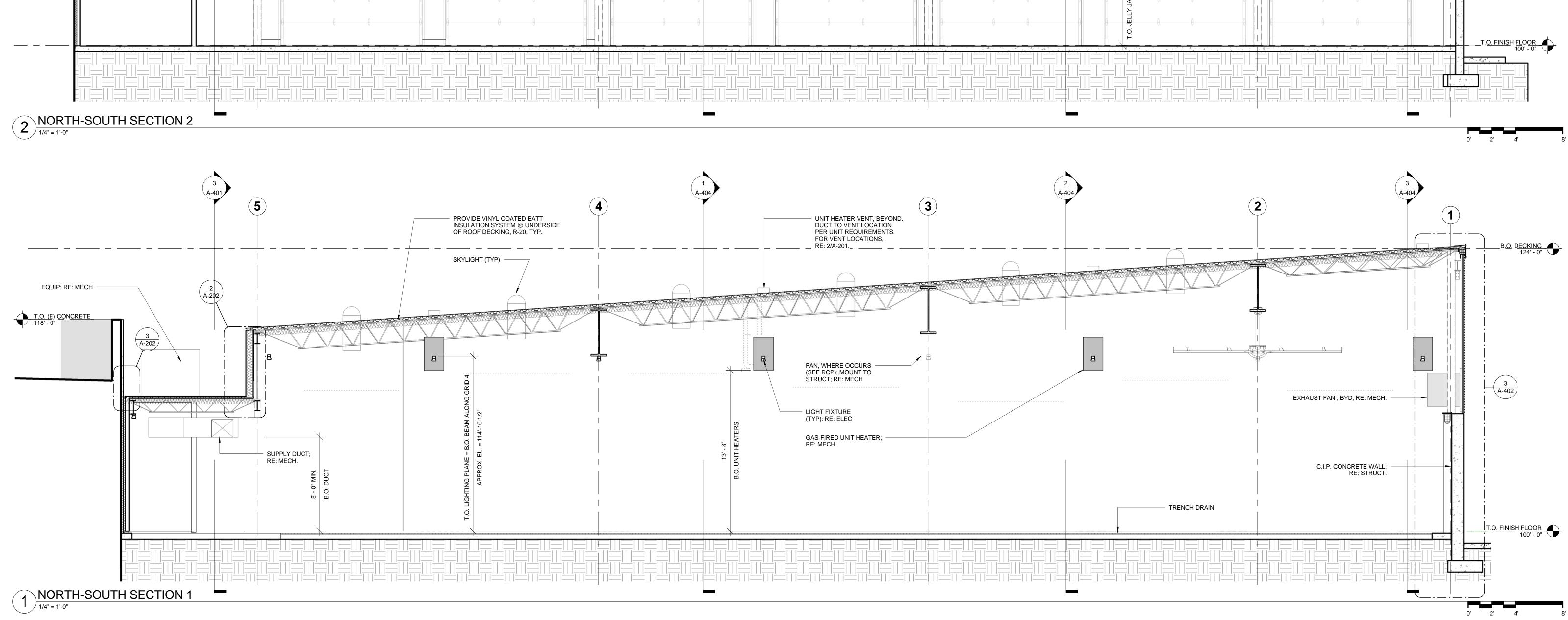








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4 A-202

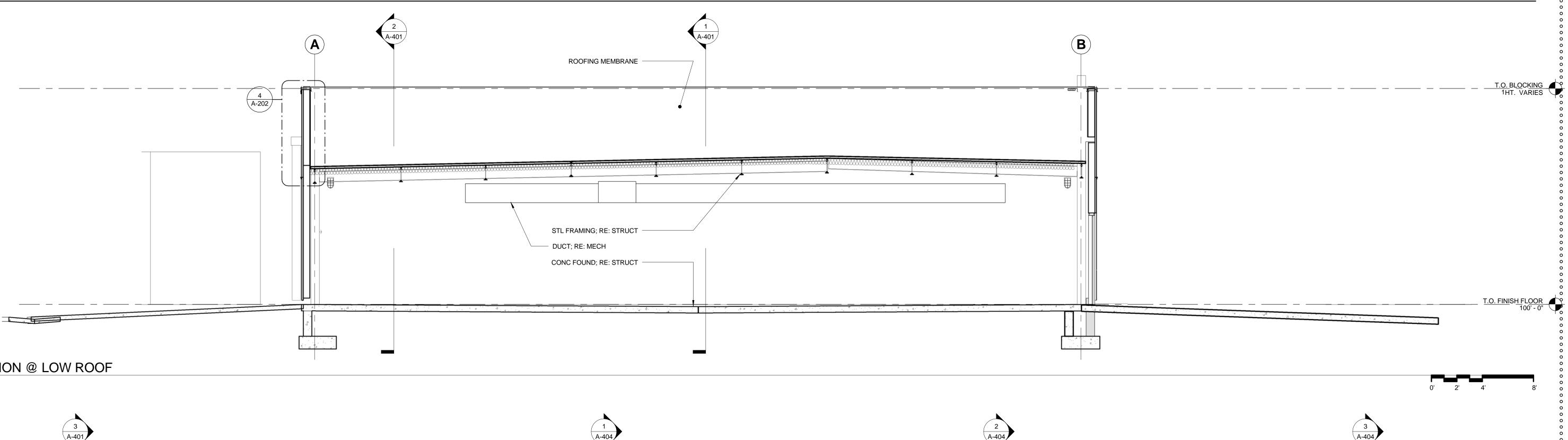
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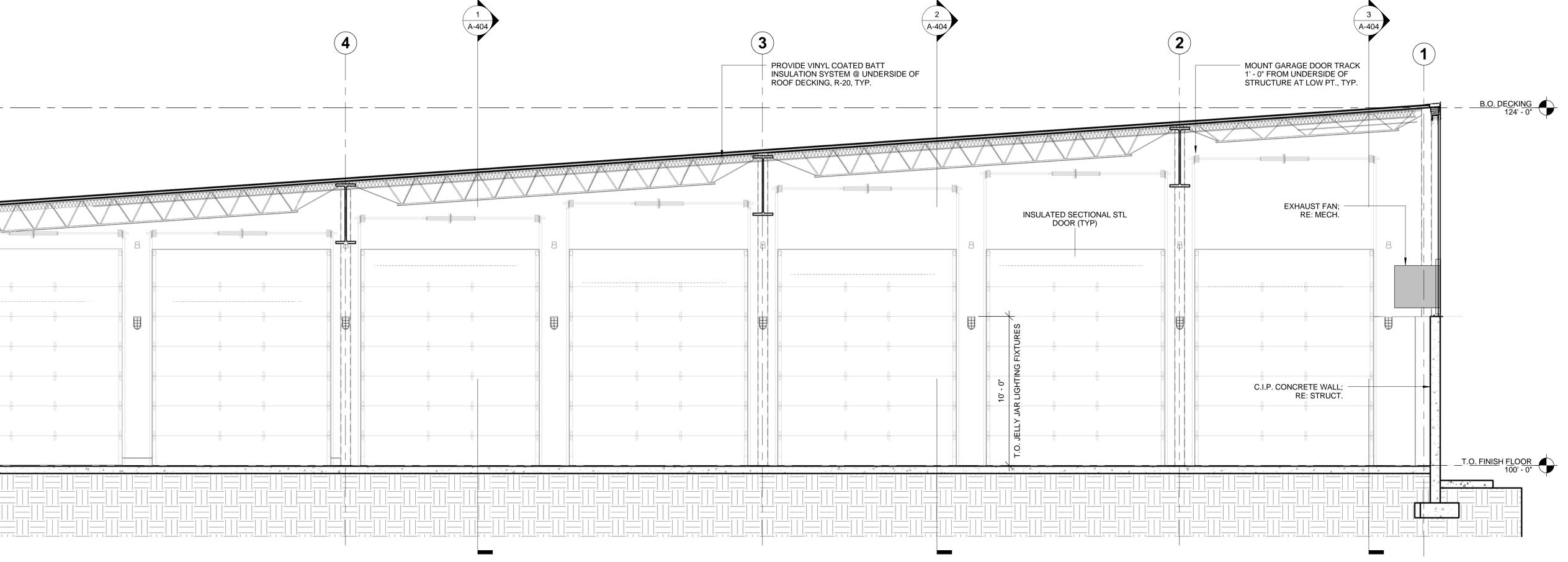
SCUPPER OPENING, BEYOND.

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T.O. (E) CONCRETE 118' - 0"

3 A-202

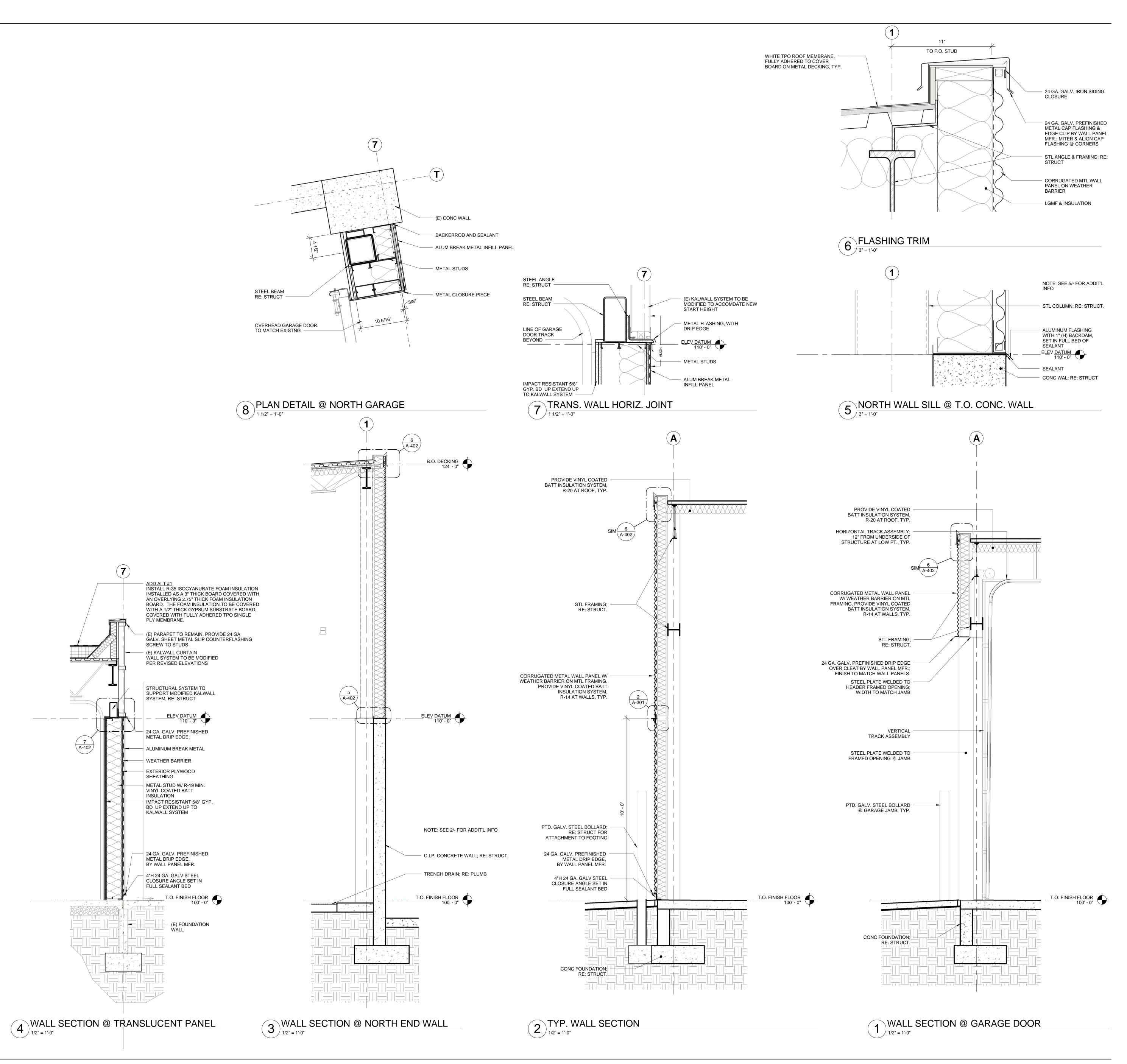




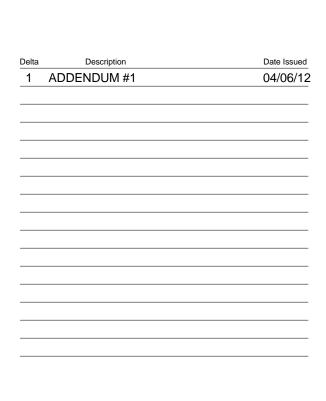


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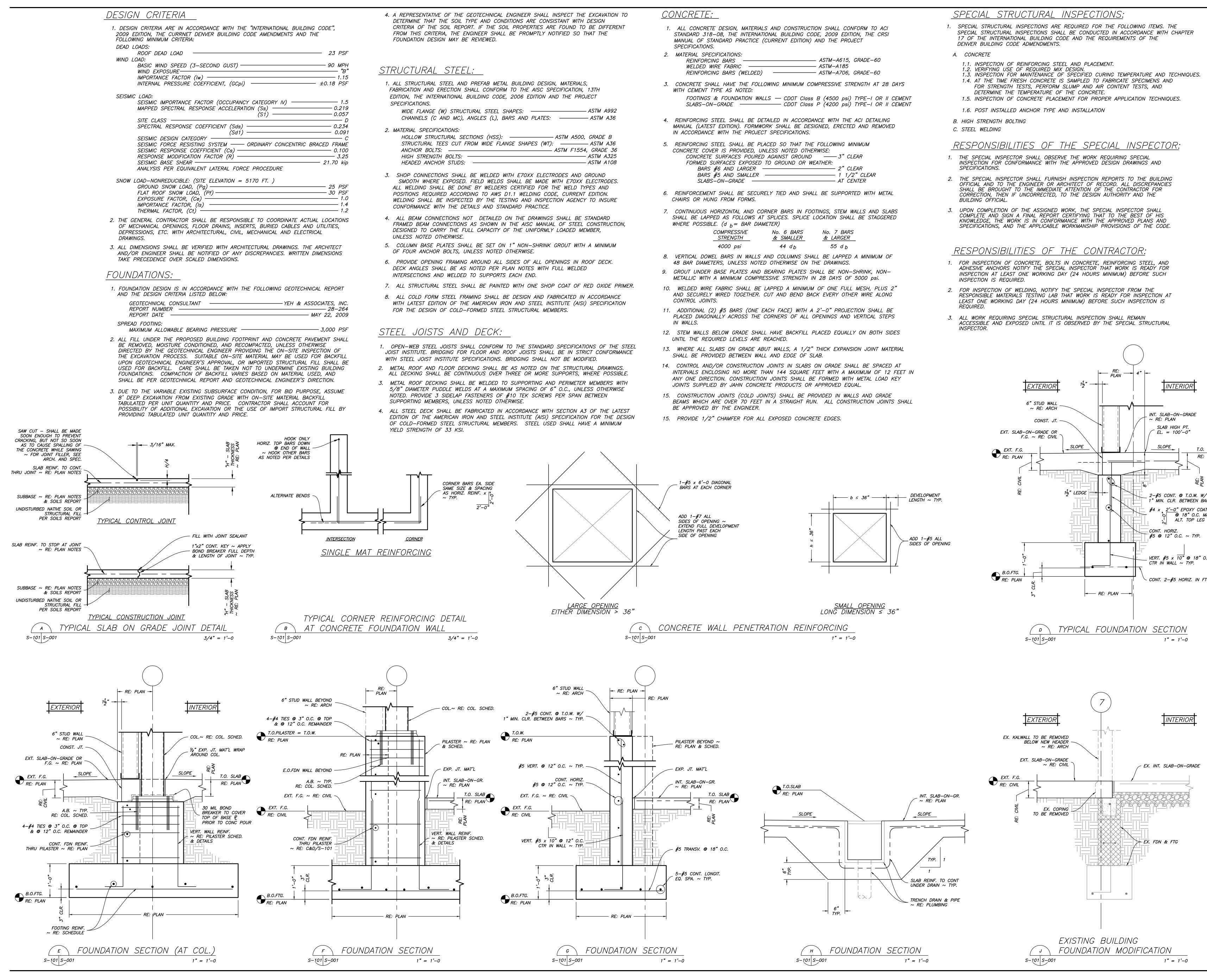
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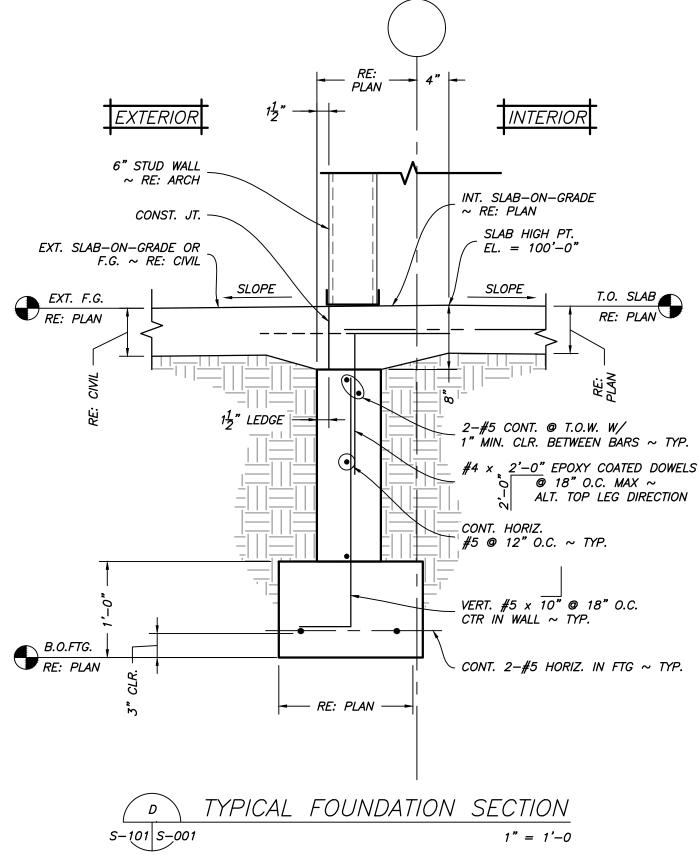






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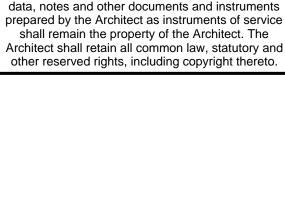


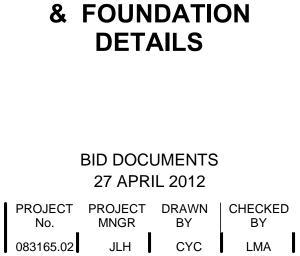


**Operations Command** Vehicle Storage & Modifications 3501 Park Avenue Denver, CO 80216

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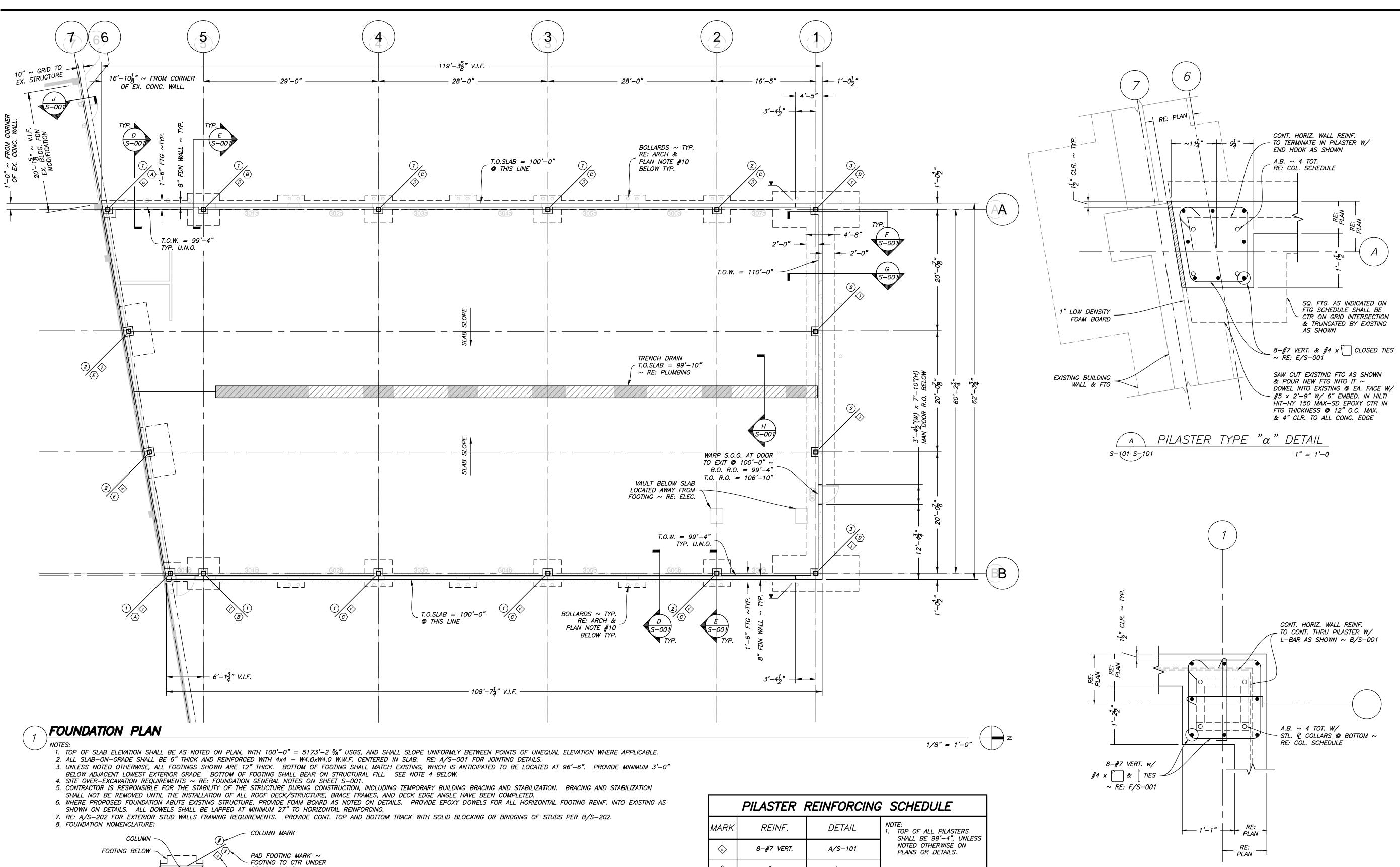


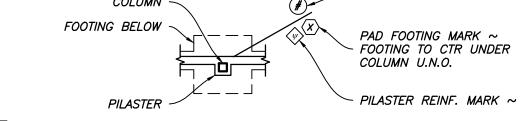


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S-001

**GENERAL NOTES** 





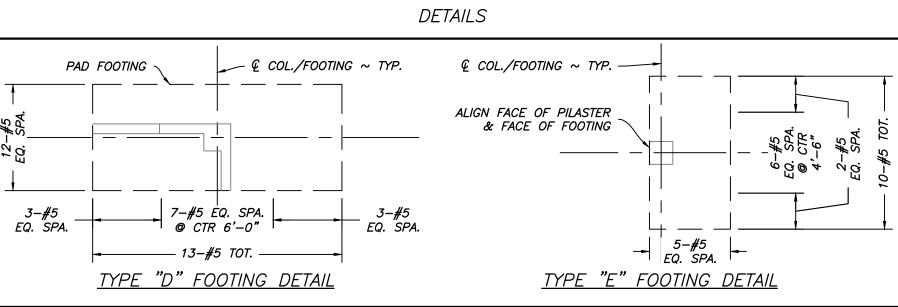
DENOTES TOP OF WALL STEP. 9. 10. BOLLARDS SHALL BE GALVANIZED AND PAINTED 6" EXTRA STRONG STEEL PIPE, CONCRETE FILLED, AND ANCHORED TO TOP OF FOOTING. PROVIDE BASE 12" × 8"× 1'-1" WITH 14" FILLET WELD ALL AROUND TO PIPE, FASTENED TO TOP OF FOOTING WITH 2 – 3/4"Ø STAINLESS STEEL HILTI KWIK BOLT TZ WITH 43/4" MIN. EMBEDMENT WITH 1/2" MIN. SHIM & GROUT. ANCHORS SHALL HAVE MINIMUM EDGE DISTANCE OF 5/2" FROM BOLT Q TO NEAREST CONCRETE EDGE. PAVEMENT CONCRETE SHALL BE POURED TIGHT ALL AROUND BOLLARDS WITH 30# FELT BOND BREAKER BETWEEN.

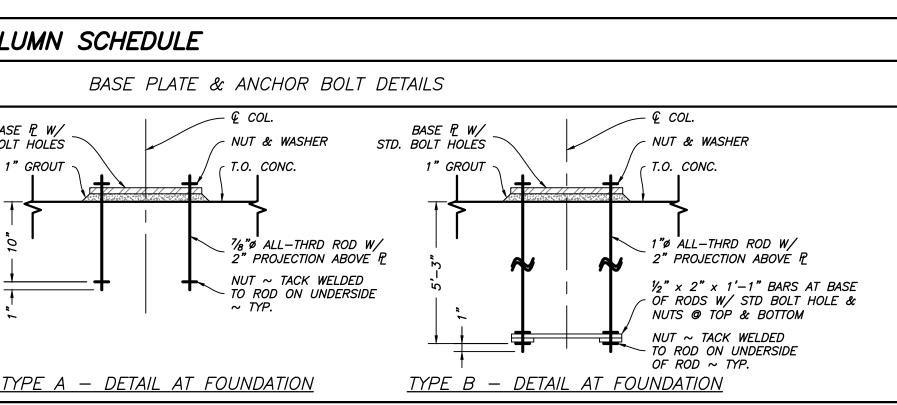
| MARK                | SIZE                      | REINF.                                         |  |
|---------------------|---------------------------|------------------------------------------------|--|
| À                   | 2'–11" SQ.<br>(TRUNCATED) | 4–#5 EQ. SPA. E.W.<br>(SEE DETAIL A & E/S–101) |  |
| B                   | 5'—4" SQ.                 | 6-#5 EQ. SPA. E.W.                             |  |
| $\langle c \rangle$ | 4'-6" SQ.                 | 5-#5 EQ. SPA. E.W.                             |  |
| Ø                   | 14'-6" x 6'-0"            | SEE ADJACENT DETAIL.                           |  |
| E                   | 4'-6" x 8'-6"             | SEE ADJACENT DETAIL.                           |  |

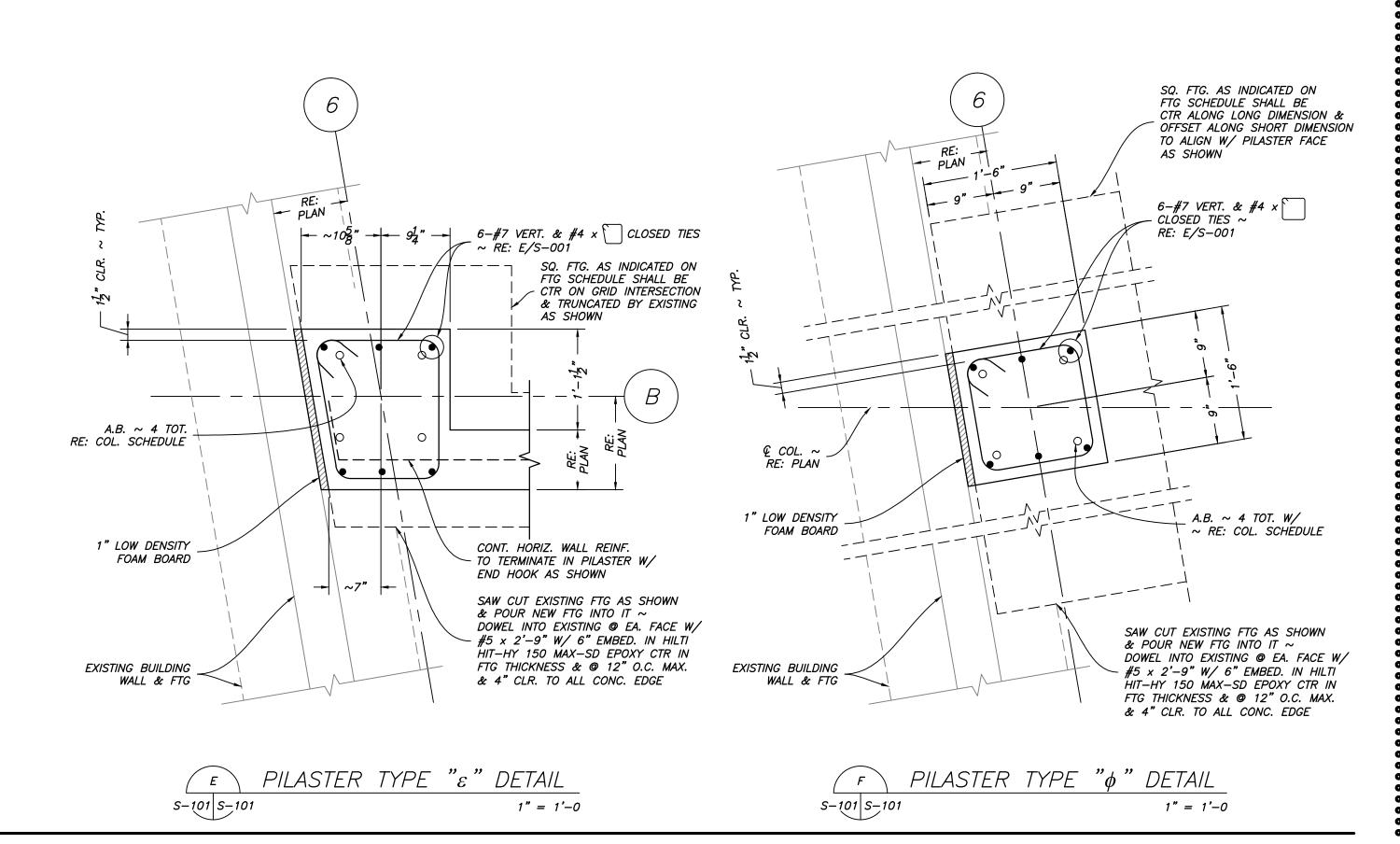
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|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|------------------------------------------|----------------------------------|-------------------|
| MARK                                                                   | SIZE                                                                                                                  | TYPE                                                                                             | BASE PLATE SIZE<br>(TxNxB)               |                                  |                   |
| 1                                                                      | HSS8x8x346                                                                                                            | A                                                                                                | 7∕8" × 1'−2" × 1'−2"                     |                                  | BASE<br>STD. BOLT |
| 2                                                                      | HSS8x8x546                                                                                                            | A                                                                                                | 7∕8" × 1'−2" × 1'−2"                     | 12"<br>TYP.                      | 1 "               |
| 3                                                                      | HSS8x8x5/16                                                                                                           | В                                                                                                | 1-1/8" × 1'-2" × 1'-2"                   |                                  | Ť                 |
| ASTM<br>2. BASE<br>3. UNLES<br>F1554<br>EMBED<br>4. PROVID<br>5. COLUM | A500, GRADE B<br>PLATES SHALL<br>S NOTED OTHEN<br>, GRADE 36, G<br>DMENT, HEAVY H<br>DE 3⁄4" CAP PLA<br>INS SHALL NOT | B.<br>BE A36 STEE<br>RWISE, ANCHO<br>ALVANIZED TH<br>IEX TOP NUT,<br>ITES, SIZE AS<br>BE SPLICE. | SHALL SPLICE BE NEEDED,                  | EQ. + EQ. + 1/4                  | <br>              |
|                                                                        |                                                                                                                       |                                                                                                  | PROPOSED COLUMN SPLICE<br>URAL ENGINEER. | <u>TYPICAL BASE PLATE DETAIL</u> | <u></u>           |

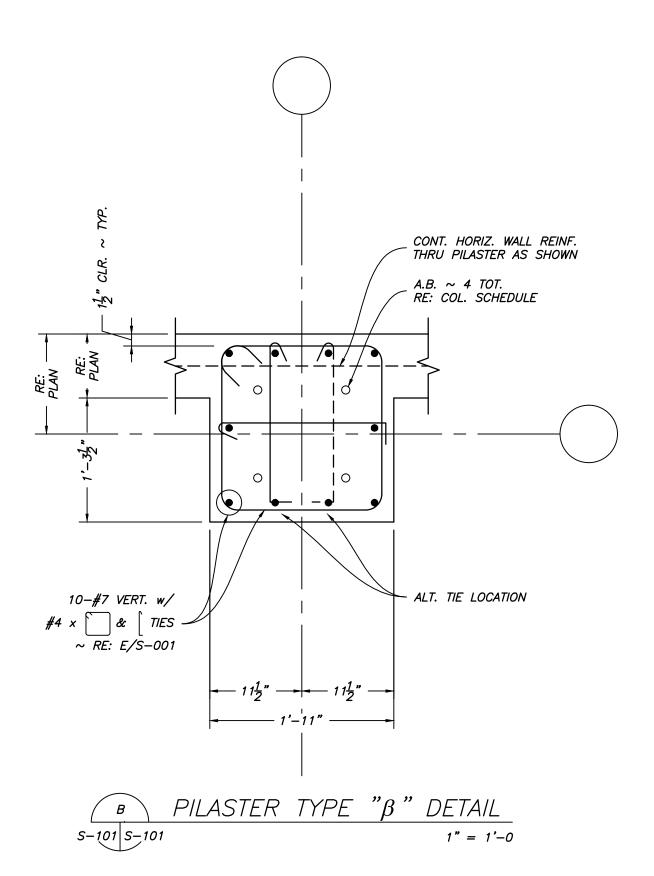
|                          | PILASTER    | REINFORCING | S SCHEDULE                                                  |
|--------------------------|-------------|-------------|-------------------------------------------------------------|
| MARK                     | REINF.      | DETAIL      | NOTE:<br>1. TOP OF ALL PILASTERS<br>SHALL BE 99'-4", UNLESS |
|                          | 8-#7 VERT.  | A/S-101     | NOTED OTHERWISE ON<br>PLANS OR DETAILS.                     |
| \$                       | 10-#7 VERT. | B/S-101     |                                                             |
| $\langle i \rangle$      | 8-#7 VERT.  | C/S-101     |                                                             |
| $\langle \delta \rangle$ | 6-#7 VERT.  | D/S-101     |                                                             |
| <u>ک</u>                 | 6-#7 VERT.  | E/S-101     |                                                             |
| ¢                        | 6-#7 VERT.  | F/S-101     |                                                             |

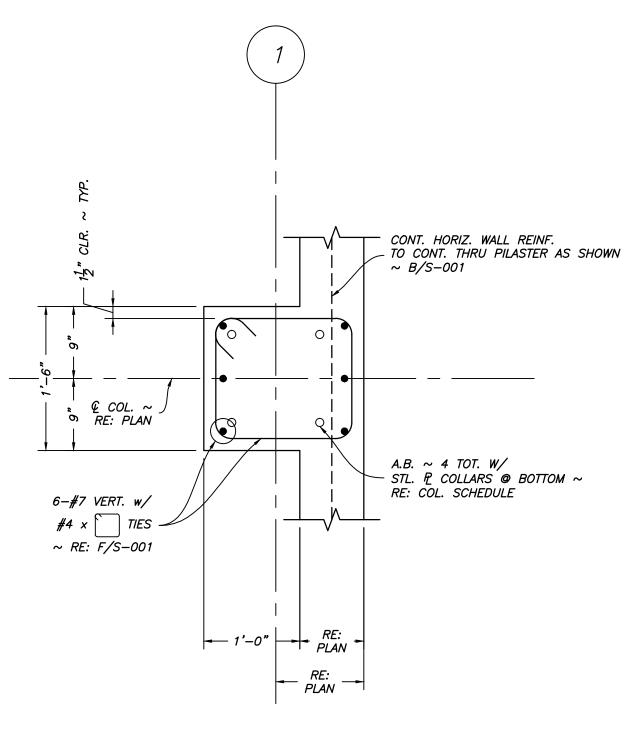
# PAD FOOTING SCHEDULE











PILASTER TYPE " $\chi$ " DETAIL S-101 S-101 1" = 1' - 0

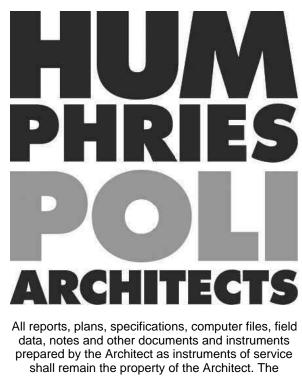
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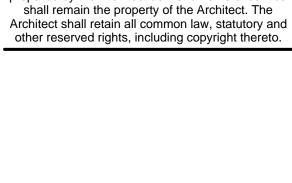


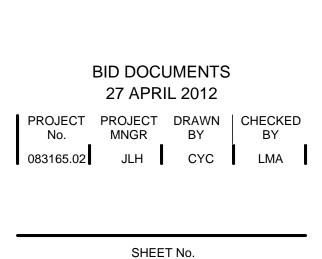


**Operations Command** Vehicle Storage & Modifications 3501 Park Avenue Denver, CO 80216

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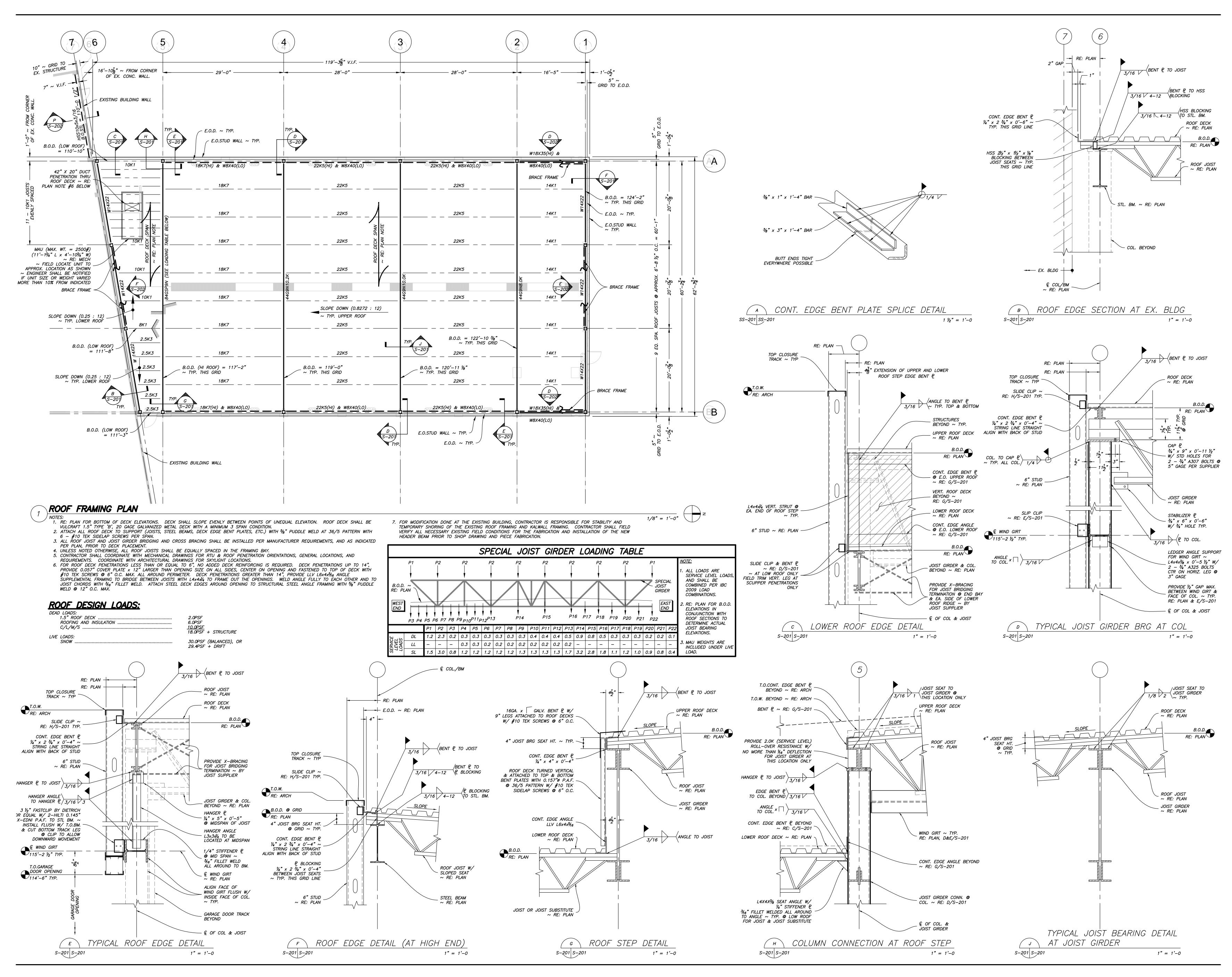


S-101

FOUNDATION PLAN

SCHEDULES

& DETAILS





Operations Command Vehicle Storage & Modifications 3501 Park Avenue Denver, CO 80216

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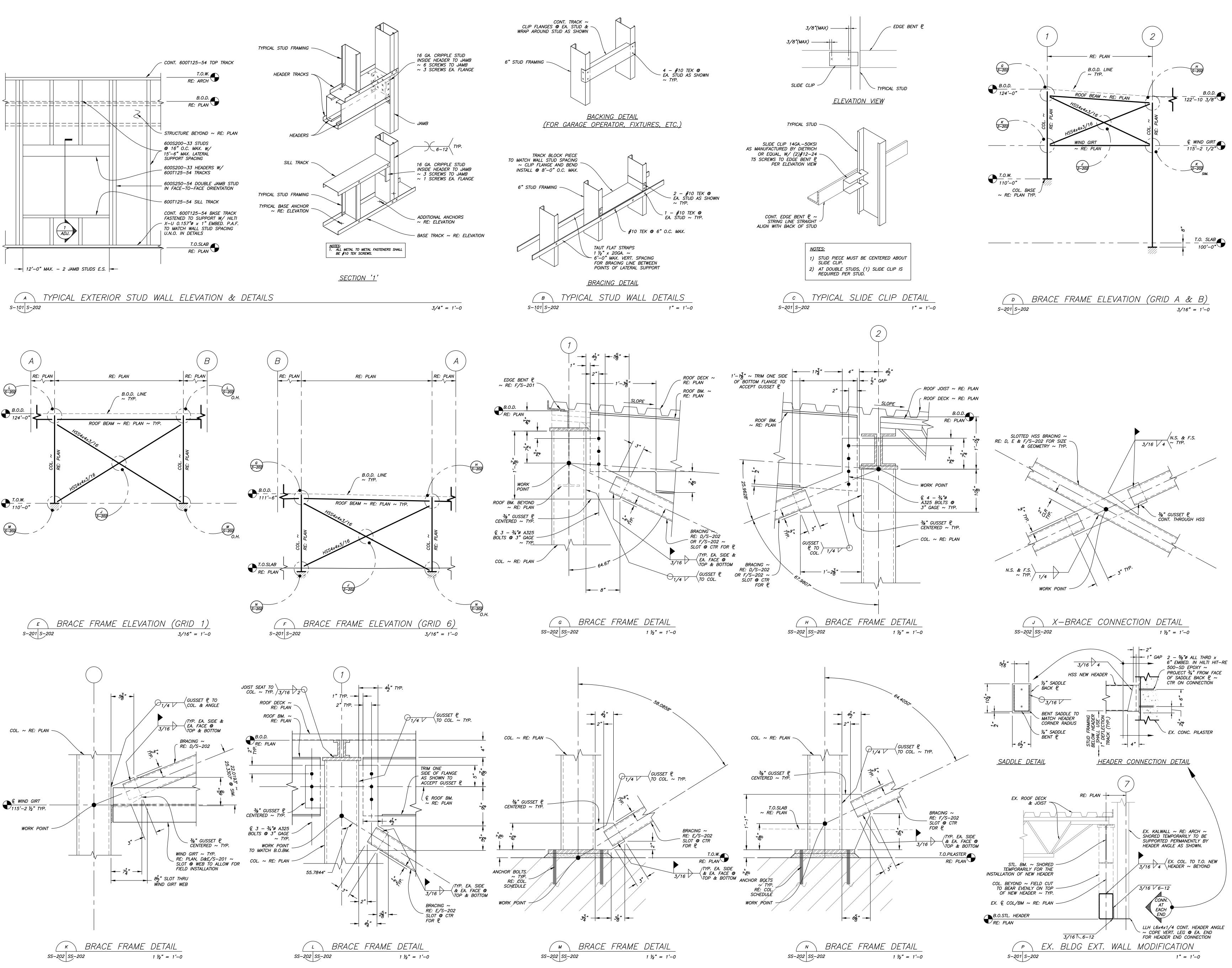


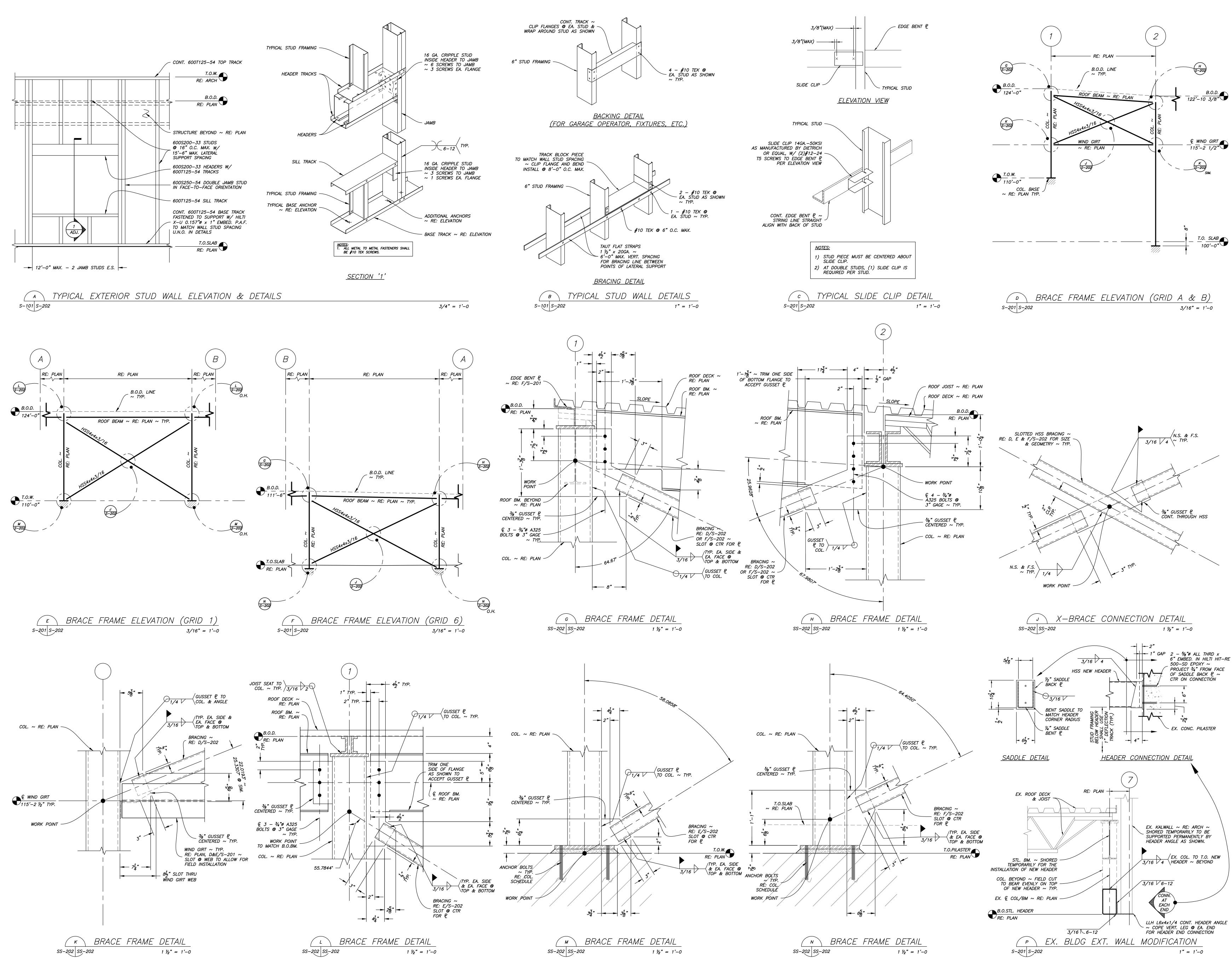




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SHEET No. S-202

## GENERAL MECHANICAL CONTRACT REQUIREMENTS:

### GENERAL:

- 1. UNLESS OTHERWISE NOTED, THE WORK DESCRIBED ON THE PLANS AND SPECIFICATIONS SHALL INCLUDE THE FURNISHING AND INSTALLATION OF ALL LABOR AND MATERIALS NECESSARY FOR COMPLETE AND OPERATIONAL HVAC, FIRE PROTECTION AND PLUMBING SYSTEMS. CONTRACTOR SHALL FURNISH THESE EVEN IF ITEMS REQUIRED TO ACHIEVE THIS (I.E. OFFSETS, ISOLATION AND BALANCING DEVICES, MAINTENANCE CLEARANCES, ETC.) ARE NOT SPECIFICALLY SHOWN.
- 2. DATA GIVEN ON THE DRAWINGS IS AS EXACT AS COULD BE SECURED. ABSOLUTE ACCURACY IS NOT GUARANTEED AND THE CONTRACTOR SHALL **OBTAIN AND VERIFY EXACT LOCATIONS, MEASUREMENTS, LEVELS, SPACE** REQUIREMENTS, POTENTIAL CONFLICTS WITH OTHER TRADES, ETC. AT THE SITE AND SHALL SATISFACTORILY ADAPT HIS WORK TO THE ACTUAL CONDITIONS OF THE JOB.
- 3. THE DRAWINGS ARE DIAGRAMMATICAL IN NATURE AND SHALL NOT BE SCALED. THEY SHOW CERTAIN PHYSICAL RELATIONSHIPS WHICH MUST BE ESTABLISHED WITHIN THE DIVISION 15 WORK AND ITS INTERFACE WITH OTHER WORK. ESTABLISHING THIS RELATIONSHIP IN THE FIELD IS THE EXCLUSIVE RESPONSIBILITY OF THE CONTRACTOR. THIS DIVISION SHALL COORDINATE ITS WORK WITH ALL DIVISIONS OF THE WORK AND ADJUST ITS WORK AS REQUIRED BY THE ACTUAL CONDITIONS OF THE PROJECT.
- A. THE CONTRACTOR SHALL VISIT THE SITE BEFORE SUBMITTING A BID TO BECOME THOROUGHLY FAMILIAR WITH THE ACTUAL CONDITIONS OF THE PROJECT. NO EXTRAS WILL BE ALLOWED DUE TO LACK OF **KNOWLEDGE OF EXISTING CONDITIONS.**
- **B. CERTAIN SYSTEMS REQUIRE ENGINEERING OF INSTALLATION DETAILS** BY CONTRACTOR. UNLESS FULLY DETAILED IN THE CONTRACT DOCUMENTS, SUCH ENGINEERING IS THE EXCLUSIVE RESPONSIBILITY OF THE CONTRACTOR.
- C. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE WHERE CLEARANCES ARE LIMITED, AND WHERE INSTALLATION DRAWINGS OR SCHEMATICS, "CONSTRUCTION DRAWINGS", OR COORDINATION DRAWINGS MAY BE REQUIRED IN ACCORDANCE WITH, OR IN EXCESS OF, THOSE **REQUIRED BY THE SPECIFICATIONS. THE CONTRACTOR SHALL PREPARE** ALL SUCH COORDINATION DRAWINGS AS PART OF THE BASE CONTRACT. SUCH DRAWINGS MAY BE SUBMITTED TO THE ARCHITECT/ENGINEER FOR **RECORD AND COMMENT (AT THE CONTRACTOR'S OPTION).**
- 4. THESE NOTES ONLY SUPPLEMENT, AND DO NOT REPLACE, THE SPECIFICATIONS.
- 5. DEFINITIONS AND TERMINOLOGY
- A. THE DEFINITIONS OF DIVISION 1 AND THE GENERAL CONDITIONS OF THIS SPECIFICATION ALSO APPLY TO THE DIVISION 15 CONTRACT DOCUMENTS.
- **B. "CONTRACT DOCUMENTS" CONSTITUTE THE DRAWINGS,** SPECIFICATIONS, GENERAL CONDITIONS, PROJECT MANUALS, ETC., PREPARED BY ENGINEER (OR OTHER DESIGN PROFESSIONAL IN ASSOCIATION WITH ENGINEER) FOR CONTRACTOR'S BID OR CONTRACTOR'S NEGOTIATIONS WITH THE OWNER. THE DIVISION 15 DRAWINGS AND SPECIFICATIONS PREPARED BY THE ENGINEER ARE NOT CONSTRUCTION DOCUMENTS.
- C. "CONSTRUCTION DOCUMENTS". "CONSTRUCTION DRAWINGS". AND SIMILAR TERMS FOR DIVISION 15 WORK REFER TO INSTALLATION DIAGRAMS, SHOP DRAWINGS AND COORDINATION DRAWINGS PREPARED BY THE CONTRACTOR USING THE DESIGN INTENT INDICATED ON THE ENGINEER'S CONTRACT DOCUMENTS. THESE SPECIFICATIONS DETAIL THE CONTRACTOR'S RESPONSIBILITY FOR "ENGINEERING BY CONTRACTOR" AND FOR PREPARATION OF CONSTRUCTION DOCUMENTS.
- D. "(N)" INDICATES "NEW" EQUIPMENT TO BE PROVIDED UNDER THIS CONTRACT.
- E. "(E)" INDICATES "EXISTING" EQUIPMENT ON SITE WHICH MAY OR MAY NOT NEED TO BE RELOCATED AS A PART OF THIS WORK.
- F. "(R)" INDICATES EXISTING EQUIPMENT TO BE RELOCATED AS PART OF THIS WORK.
- G. "FURNISH" MEANS TO "SUPPLY" AND USUALLY REFERS TO AN ITEM OF EQUIPMENT.
- H. "INSTALL" MEANS TO "SET IN PLACE, CONNECT AND PLACE IN FULL **OPERATIONAL ORDER".**
- I. "PROVIDE" MEANS TO "FURNISH AND INSTALL".
- J. "EQUIVALENT" MEANS "MEETS THE SPECIFICATIONS OF THE **REFERENCE PRODUCT OR ITEM IN ALL SIGNIFICANT ASPECTS."** SIGNIFICANT ASPECTS SHALL BE AS DETERMINED BY THE ARCHITECT/ENGINEER.
- K. "WORK BY OTHER(S) DIVISIONS"; "RE: XX DIVISION", AND SIMILAR EXPRESSIONS MEANS WORK TO BE PERFORMED UNDER THE CONTRACT DOCUMENTS, BUT NOT NECESSARILY UNDER THE DIVISION OR SECTION OF THE WORK ON WHICH THE NOTE APPEARS. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO COORDINATE THE WORK OF THE CONTRACT BETWEEN HIS/HER SUPPLIERS, SUBCONTRACTORS AND EMPLOYEES. IF CLARIFICATION IS REQUIRED, CONSULT ARCHITECT/ENGINEER BEFORE SUBMITTING BID.
- L. BY INFERENCE, ANY REFERENCE TO A "CONTRACTOR" OR "SUB-CONTRACTOR" MEANS THE ENTITY WHICH HAS CONTRACTED WITH THE OWNER FOR THE WORK OF THE CONTRACT DOCUMENTS.
- M. "ENGINEER" MEANS THE DESIGN PROFESSIONAL FIRM WHICH HAS PREPARED THESE CONTRACT DOCUMENTS. ALL QUESTIONS, SUBMITTALS, ETC. OF THIS DIVISION SHALL BE ROUTED THROUGH THE ARCHITECT TO THE ENGINEER (THROUGH PROPER CONTRACTUAL CHANNELS).
- **ELECTRICAL COORDINATION:**
- VERIFY THE ELECTRICAL SERVICE PROVIDED BY THE ELECTRICAL CONTRACTOR BEFORE ORDERING ANY MECHANICAL EQUIPMENT REQUIRING ELECTRICAL CONNECTIONS.
- PROVIDE HIGH EFFICIENCY MOTORS WITH 1.15 SERVICE FACTOR ON ALL EQUIPMENT, MOTORS SHALL BE CAPABLE OF OPERATING CONTINUOUSLY AT 105°F UNDER JOBSITE CONDITIONS AND ALTITUDE.
- 3. UNLESS NOTED OTHERWISE, ALL MECHANICAL EQUIPMENT SHALL BE PROVIDED WITH HOA SWITCH AND STARTER COMPATIBLE WITH EQUIPMENT AND BMS SYSTEM. STARTERS SHALL BE PROVIDED BY DIVISION 15 UNLESS IN A MOTOR CONTROL CENTER. ALL DISCONNECTS SHALL BE FURNISHED BY DIVISION 16.
- 4. THE ELECTRICAL POWER FOR CERTAIN EQUIPMENT PROVIDED UNDER DIVISION 15 HAS NOT BEEN SPECIFICALLY INDICATED ON THE ELECTRICAL DRAWINGS AND MUST BE PROVIDED BY AND FIELD COORDINATED BY THE DIVISION 15 TRADE REQUIRING SUCH POWER.
- SUFFICIENT POWER FOR THIS PURPOSE SHALL BE FURNISHED AS "SPARE", DEDICATED CIRCUIT CAPACITY IN DIVISION 16'S PANELBOARDS. ALL WIRING. CONDUIT AND ELECTRICAL DEVICES DOWNSTREAM OF THE PANELBOARDS IS THE RESPONSIBILITY OF THE DIVISION 15 TRADE REQUIRING THE POWER UNLESS OTHERWISE SHOWN ON THE ELECTRICAL DRAWINGS.
- SUCH EQUIPMENT IS HEREBY DEFINED AS:
- A. ELECTRICAL HEAT TRACE. REQUIRED HEAT TRACE LOCATIONS, CAPACITIES AND SPECIFICATION ARE SHOWN OR INDICATED ON THE DRAWINGS. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.
- B. FIRE PROTECTION AIR COMPRESSORS, DRY-PIPE CONTROL PANELS AND VALVES. REQUIRED CONNECTIONS ARE INCLUDED IN THE DIVISION 15300 WORK, AND WILL BE SHOWN BY THAT CONTRACTOR'S ENGINEERED SYSTEM DESIGN DRAWINGS.
- PRE-ACTION SYSTEM INITIATION SIGNALS (SUCH AS SMOKE DETECTORS, OR GENERAL ALARM CONDITIONS IN A PRE-ACTION ZONE) SHALL BE PROVIDED UNDER DIVISION 16 FIRE-ALARM WORK.
- DIVISION 15300 SHALL PROVIDE PRE-ACTION CONTROL PANEL (1) AND INTERCONNECTION BETWEEN NEAREST SUITABLE FIRE ALARM PANEL AND LOCATION OF PRE-ACTION VALVE(S).
- DIVISION 16 SHALL PROVIDE INTERCONNECTION BETWEEN FIRE COMMAND CENTER ALARM PANEL (PROVIDED UNDER DIVISION 16) AND REMOTE COMMUNICATION FIRE ALARM PANEL (PROVIDED UNDER DIVISION 16).

- TEMPERATURE CONTROL PANELS, CONTROL AIR COMPRESSORS AND L VOLTAGE POWER FOR 24V CONTROL TRANSFORMERS. REQUIRED **CONNECTION ARE INCLUDED IN DIVISION 15950 AND WILL BE SHOWN** BY THAT CONTRACTOR'S CONTROL SUBMITTAL DRAWINGS.
- D. IT IS NOT PERMISSIBLE TO UTILIZE "SPARE" POWER FROM ADJACENT POWER CIRCUITS TO SERVE ANY OF THE ABOVE LOADS. ALL POWER MUST COME FROM DEDICATED CIRCUITS. SMOKE DETECTORS:
- FOR AIR HANDLING UNITS AND AIR SYSTEMS WITH A CAPACITY EXCEEDING 2000 CFM. PROVIDE UL LISTED SMOKE DETECTORS IN RETURN AIR SYSTEMS IN ACCORDANCE WITH THE INTERNATIONAL MECHANICAL C ELSEWHERE AS SHOWN ON THE DRAWINGS.
- SMOKE DETECTORS WILL BE FURNISHED AND SET IN PLACE UNDER THIS DIVISION. DETECTORS WILL BE WIRED UNDER DIVISION 16. SMOKE DETEC MUST BE OF THE SAME MANUFACTURER, AND COMPATIBLE WITH THE FIRE ALARM SYSTEM PROVIDED UNDER DIVISION 16 (IF APPLICABLE).
- CONNECT RELAY(S) TO FAN CONTROL CIRCUIT TO STOP FAN WHEN SMOK DETECTED.
- **INSTALLATION:** 1. SUSPEND EACH TRADE'S WORK SEPARATELY FROM THE STRUCTURE
- SHALL BE HELD TIGHT TO STRUCTURE EXCEPT WHERE OTHERWISE SHOW 2. INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY INDICATEI
- OTHERWISE OR WHERE LOCAL CODES OR REGULATIONS TAKE PRECEDEN 3. PROVIDE MANUFACTURER'S RECOMMENDED SERVICE CLEARANCE AF EQUIPMENT REQUIRING SAME.
- 4. PROVIDE FOR SAFE CONDUCT OF THE WORK, CAREFUL REMOVAL AND OF MATERIALS AND PROTECTION OF PROPERTY WHICH IS TO REMAIN UND
- 5. PROVIDE ACCESS DOORS FOR ALL EQUIPMENT, VALVES, CLEANOUTS AND CONTROLS WHICH REQUIRE ACCESS FOR ADJUSTMENT OR SERVICING WHICH ARE LOCATED IN OTHERWISE INACCESSIBLE LOCATIONS.
- A. FOR EQUIPMENT LOCATED IN "ACCESSIBLE LOCATIONS" SUCH AS LAY CEILINGS: LOCATE EQUIPMENT TO PROVIDE ADEQUATE SERVICE CLEAR FOR NORMAL MAINTENANCE WITHOUT REMOVING ARCHITECTURAL, EL OR STRUCTURAL ELEMENTS SUCH AS THE CEILING SUPPORT SYSTEM, ELECTRICAL FIXTURES, ETC. "NORMAL MAINTENANCE" INCLUDES, BU NOT LIMITED TO:FILTER CHANGING; GREASING OF BEARINGS; USING P PORTS FOR PRESSURE OR TEMPERATURE MEASUREMENTS; SERVICING CONTROL VALVES AND SERVICING CONTROL PANELS.
- 6. ISOLATE ALL PRESSURIZED PIPE (WATER, ETC.) AT EACH RISER, BRAN OF EQUIPMENT, AND AREA SERVED.
- 7. PROVIDE PRIMERS FOR ALL FLOOR DRAINS AND FLOOR SINKS SHOWN DRAWINGS. PRIMERS MAY BE CONNECTED TO FLUSH FIXTURES OR BE STA ALONE. SEE SPECIFICATIONS.
- 8. NO DOMESTIC WATER, CHILLED WATER, OR HEATING WATER LINES SH LOCATED EXPOSED IN FINISHED SPACES OR BELOW THE BUILDING SLAB SHOWN OTHERWISE ON THE DRAWINGS.
- 9. NO GAS LINES SHALL BE LOCATED BELOW BUILDING SLAB.
- 10. ALL CURBS, ROOF JACKS, ROOF THIMBLES, SANITARY VENTS, ROOF D ETC. SHALL BE COMPATIBLE WITH ROOFING SYSTEM TO BE PROVIDED. **REFERENCE ARCHITECTURAL DIVISION FOR REQUIRED FLASHING DETAILS**
- 11. MECHANICAL CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL CON EQUIPMENT PAD DIMENSIONS, BASED ON THE FINAL EQUIPMENT SELECTION TO THE STRUCTURAL AND GENERAL CONTRACTOR FOR INCLUSION IN THE CONTRACTOR'S WORK AS DESCRIBED BY THE GENERAL CONTRACTOR.
- 12. WARRANTY: AT A MINIMUM, THE ENTIRE MECHANICAL SYSTEM SHAL WARRANTED AGAINST DEFECTS IN MATERIALS AND WORKMANSHIP FOR A OF ONE (1) YEAR AFTER ACCEPTANCE OF THE SYSTEM BY THE OWNER. R TO INDIVIDUAL SPECIFICATION SECTIONS FOR SPECIFIC WARRANTY REQU
- DUCTWORK INSTALLATION: 1. SEAL ALL SEAMS (LONGITUDINAL AND TRANSVERSE) AIR TIGHT WITH S
- SPECIFICATIONS.
- 2. DUCT DIMENSIONS ARE INSIDE CLEAR.
- 3. DIFFUSER NECK SIZE IS SAME AS FLEXIBLE DUCT SIZE.
- 4. UNLESS OTHERWISE NOTED, ALL CHANGES IN DIRECTION SHALL BE MA **RADIUS ELBOWS WITH RADIUS TO CENTERLINE EQUAL TO 1.5 DUCT WIDTH**
- 5. WHERE REQUIRED FOR SPACE CONSTRAINTS, PROVIDE MITERED ELBOW TURNING VANES AS FOLLOWS:
- A. FOR DUCT WIDTHS OF 36" OR LESS, PROVIDE MANUFACTURED SINGLE WIDTH TURNING VANES, WITH NO TRAILING EDGES AND SPACING IN ACCORDANCE WITH SMACNA DUCT CONSTRUCTION STANDARDS FOR "STANDARD SPACING".
- USE DOUBLE THICKNESS (AIRFOIL) BLADES WITHOUT TRAILING EDGES FOR DUCT WIDTHS GREATER THAN 36".
- 6. ALL FLEXIBLE DUCTS SHALL NOT BE LESS THAN 4', OR MORE THAN 10' LENGTH. INSTALL FLEXIBLE DUCTWORK SUCH THAT:
- A. MINIMUM OVERALL LENGTH OF 3D, STRAIGHT INTO NECK OF DIFFUSER
- B. MAXIMUM OF 135° OF TOTAL TURNING IN ENTIRE LENGTH OF FLEXIBLE
- C. MINIMUM TURNING RADIUM OF R = 1.5D.
- WHERE: D = FLEXIBLE DUCT DIAMETER
- \* R = RADIUS OF TURN AS MEASURED TO CENTERLINE OF DUCT.
- 7. BRANCH LINES:
- A. MAKE ALL TAPS TO ROUND DUCTWORK WITH CONICAL TEES.
- B. MAKE ALL TAPS TO RECTANGLE DUCTWORK WITH 45° ENTRY OR CONI SPIN IN TO ROUND.
- C. INCLUDE DAMPERS AT ALL BRANCH LINES.
- 8. DUCT SIZES NOT CALLED OUT SHALL BE DETERMINED BASED ON 0.08" S OR LESS PER 100 FT. OF LENGTH.
- 9. ASSUME ROUND OR OVAL DUCTS IN EXPOSED AREAS.
- 10. INCLUDE DAMPERS AT ALL BRANCH LINES, WHERE SHOWN ON THE DR/ WHERE OTHERWISE REQUIRED FOR BALANCING.

### **PIPE INSTALLATION:**

- 1. ALL PIPING SHALL BE ADEQUATELY SUPPORTED FROM THE BUILDING STRUCTURE TO PREVENT SAGGING, POCKETING, SWAYING OR DISPLACEM MEANS OF HANGERS AND SUPPORTS. PIPING IS NOT TO BE SUPPORTED E EQUIPMENT.
- PROVIDE DIELECTRIC UNIONS BETWEEN DISSIMILAR MATERIALS.
- PROVIDE MANUAL AIR VENTS AND CAPPED HOSE-END DRAINS WITH ISC VALVES AT PIPING HIGH AND LOW POINTS.
- WELD PIPE IN ACCORDANCE WITH APPLICABLE CODES AND STANDARD WELDERS SHALL BE CERTIFIED FOR TYPE OF WORK BEING PERFORMED.
- 5. FLUSH OUT PIPING AND REMOVE CONTROL DEVICES BEFORE PERFORM PRESSURE TEST. DO NOT USE PIPING SYSTEM VALVES TO ISOLATE SECTI WHERE TEST PRESSURE EXCEEDS VALVE PRESSURE RATING. PRESSURIZ PIPING AT 100 PSIG. IF LEAKAGE IS OBSERVED OR IF TEMPERATURE COMPENSATED PRESSURE DROP EXCEEDS 1% OF TEST PRESSURE, REPA AND RETEST. DO NOT USE AIR PRESSURE TO TEST PLASTIC PIPE.
- 6. PROVIDE SUPPORT UNDER ELBOWS ON PUMP SUCTION AND DISCHARC 7. ALL STRAINERS SHALL BE FURNISHED WITH A "ROUGHING" SCREEN AN
- (2) SCREENS FOR NORMAL OPERATION. INSTALL STRAINER WITH ROUGHI SCREEN AND OPERATE SYSTEM FOR 24 HOURS MINIMUM (RUN DOMESTIC) SYSTEMS AT MAX FLOW FOR A MINIMUM OF ONE HALF (1/2) HOUR. REMOV ROUGHING SCREEN AND INSTALL NORMAL SCREEN, AFTER TWO WEEKS O
- **OPERATION INSTALL NEW NORMAL SCREEN.** 8. PIPING SIZES SHALL BE BASED ON 2' OR LESS HEAD LOSS PER 100 FEET VELOCITIES SHALL NOT EXCEED 10 FEET PER SECOND.
- 9. INSTALL ALL PIPING TO ALLOW FOR EXPANSION AND CONTRACTION WI PIPING SYSTEM. ENSURE ALL REQUIRED PIPE EXPANSION WILL OCCUR IN **PROPER DIRECTION AND SEGMENT OF PIPE. PROPERLY ANCHOR (RE: SPE** ALL PIPING REQUIRING EXPANSION/CONTRACTION ISOLATION. COORDINA EXPANSION/CONTRACTION TO PREVENT DAMAGE TO ANY AND ALL BUILDI COMPONENTS.
- 10. PROVIDE ISOLATION VALVES AT EVERY HYDRONIC BRANCH LINE.

| DLINE                              | LOUVERS:                                                                                                                                                                                                                                                                                                                                      |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                    | <ol> <li>ALL LOUVERS LOCATED ON EXTERIOR WALLS SHALL BE PROVIDED BY<br/>ARCHITECTURAL DIVISION. ALL OTHER LOUVERS SHALL BE PROVIDED BY<br/>DIVISION 15. REQUIRED LOUVER FREE AREAS ARE INDICATED ON DIVISION</li> </ol>                                                                                                                       |
|                                    | 15 DRAWINGS. IT IS THE RESPONSIBILITY OF THIS CONTRACTOR TO<br>CONFIRM THAT THE REQUIRED FREE AREA HAS BEEN PROVIDED, PRIOR TO                                                                                                                                                                                                                |
|                                    | CONNECTION TO THAT LOUVER. DIVISION 15 SHALL PROVIDE ALL LOUVER<br>PLENUMS.                                                                                                                                                                                                                                                                   |
| NG                                 |                                                                                                                                                                                                                                                                                                                                               |
| CODE AND                           | 1. KEEP DEMOLITION & CUTTING TO MINIMUM REQUIRED FOR PROPER<br>EXECUTION OF WORK.                                                                                                                                                                                                                                                             |
| i                                  | 2. BE RESPONSIBLE FOR ALL CUTTING AND PATCHING NECESSARY FOR THE<br>COMPLETION OF THE WORK.                                                                                                                                                                                                                                                   |
| CTORS<br>RE                        | 3. NO CUTTING (NOT SHOWN ON THE CONTRACT DOCUMENTS) SHALL BE DONE<br>WITHOUT THE APPROVAL OF THE ARCHITECT AS TO LOCATIONS, METHOD AND                                                                                                                                                                                                        |
| KE IS                              | EXTENT OF THE CUTTING.<br>4. REPAIR ALL ACCIDENTAL OR INTENTIONAL DAMAGE TO MATCH EXISTING<br>CONSTRUCTION WITH NO NOTICEABLE DIFFERENCE IN CONTINUITY,<br>APPEARANCE OR FUNCTION.                                                                                                                                                            |
| E. DUCTWORK<br>WN.                 | 5. ALL "CAPPED" SANITARY AND VENT LINES SHALL BE RECONNECTED OR RE-<br>ROUTED AS NECESSARY TO PREVENT "DEAD-ENDS" IN THE PIPING. ALL<br>PIPING SHALL DRAIN TO ACTIVE SANITARY WASTE LINES AND ALL BRANCHES                                                                                                                                    |
| ED                                 | WITH TRAPS SHALL BE ADEQUATELY VENTED.<br>GENERAL PLUMBING CONTRACT REQUIREMENTS:                                                                                                                                                                                                                                                             |
| ENCE.<br>AROUND ALL                | 1. THE GENERAL MECHANICAL REQUIREMENTS PERTAIN TO THE WORK OF THIS                                                                                                                                                                                                                                                                            |
| ND DISPOSITION<br>IDISTURBED.      | DIVISION.<br>2. PREPARE SHOP DRAWINGS OF ALL NEW WORK (INCLUDING SLEEVE LOCATIONS)<br>TO VERIFY LOCATIONS AND COORDINATION OF WORK BETWEEN TRADES PRIOR                                                                                                                                                                                       |
| S, ACTUATORS                       | TO INSTALLATION.<br>3. ALL DRAIN GRATES, CLEANOUT COVERS, AND OTHER FINISHED, EXPOSED<br>COMPONENTS SHALL BE PROTECTED FROM DAMAGE. DAMAGED COMPONENTS                                                                                                                                                                                        |
| Y-IN<br>ARANCE<br>ELECTRICAL       | SHALL BE REPLACED BY CONTRACTOR AT NO ADDITIONAL COST TO THE<br>CONTRACT.<br>4. COORDINATE ROUTING OF ALL PLUMBING PIPING BELOW SLAB WITH                                                                                                                                                                                                     |
| UT IS<br>P/T                       | STRUCTURAL GRADE BEAMS, TIE BEAMS, ETC. ALLOW FOR REROUTING OF<br>PIPING AS REQUIRED.<br>5. ALL REQUIRED OPENINGS IN CONCRETE BEAMS AND STRUCTURAL WALLS ARE                                                                                                                                                                                  |
| NG<br>NCH, PIECE                   | TO BE ACCOMPLISHED USING SLEEVES PROPERLY SIZED FOR THE PIPE THEY<br>SERVE. CORE DRILLING IN BEAMS IS NOT ALLOWED. CORE DRILLING IN<br>PANS IS ALLOWED UPON PRIOR APPROVAL OF ARCHITECT AND STRUCTURAL<br>ENGINEER.                                                                                                                           |
| VN ON<br>TAND                      | 6. HORIZONTAL STORM AND SANITARY PIPING SHALL RUN AT A SLOPE OF 1/4"<br>PER FOOT MINIMUM FOR 3" AND SMALLER PIPING. 4" AND LARGER PIPING<br>SHALL RUN AT 1/8" PER FOOT MINIMUM.                                                                                                                                                               |
| SHALL BE<br>3 UNLESS               | 7. NO DOMESTIC WATER LINES SHALL BE LOCATED EXPOSED IN FINISHED<br>SPACES OR BELOW THE BUILDING SLAB UNLESS SHOWN OTHERWISE ON THE                                                                                                                                                                                                            |
|                                    | DRAWINGS.<br>8. WHERE SHOWN, MINIMIZE THE NUMBER OF JOINTS ON ANY PRESSURIZED<br>PIPING BELOW CONCRETE SLABS. ALL BELOW GRADE PIPING TO BE                                                                                                                                                                                                    |
| DRAINS,<br>_S.                     | PRESSURE TESTED AND WITNESSED BY ARCHITECT BEFORE BACKFILLING.<br>9. ALL CLEANOUTS FOR HORIZONTAL STORM DRAINAGE SYSTEM SHALL BE PIPE                                                                                                                                                                                                         |
| ONCRETE                            | SIZE OR MAXIMUM 6" FOR LARGER PIPE.                                                                                                                                                                                                                                                                                                           |
| fion,<br>Iose                      | 10. IN ADDITION TO THE CLEANOUT LOCATIONS SHOWN ON DRAWINGS, PROVIDE<br>ADDITIONAL CLEANOUTS AT:                                                                                                                                                                                                                                              |
| L BE                               | <ul><li>A. ALL UPPER TERMINALS.</li><li>B. EACH RUN OF PIPING WHICH IS MORE THAN 100 FEET IN LENGTH OR</li></ul>                                                                                                                                                                                                                              |
| REFER<br>PUIREMENTS.               | FRACTION THEREOF.                                                                                                                                                                                                                                                                                                                             |
|                                    | C. HORIZONTAL LINES 5 FEET OR MORE.<br>D. HORIZONTAL LINES FOR EACH AGGREGATE CHANGE OF DIRECTION                                                                                                                                                                                                                                             |
| SEALANT PER                        | EXCEEDING 135 DEGREES.<br>E. AT THE BASE OF ALL WASTE AND VENT RISERS. ALL VERTICAL                                                                                                                                                                                                                                                           |
|                                    | CLEANOUTS SHALL BE SIZED TO ACCOMMODATE THE LARGEST PIPE ON<br>THAT BRANCH LINE, BUT NEVER LARGER THAN 4".                                                                                                                                                                                                                                    |
| IADE WITH                          | 11. NO GAS LINES SHALL BE LOCATED BELOW BUILDING SLAB. ALL GAS PIPING<br>IN AIR PLENUMS TO BE WELDED.                                                                                                                                                                                                                                         |
| TH.                                | 12. PROVIDE ISOLATION VALVES ON ALL PIPING SERVING HOSE BIBBS.                                                                                                                                                                                                                                                                                |
|                                    | 13. ANY ELECTRICAL SPACE NOT CONSTRUCTED WITH A SUB-ROOF WHICH MAY<br>HAVE PLUMBING PIPING AT THE CEILING OF THESE SPACES SHALL HAVE A<br>DRIP PAN INSTALLED BELOW THE PIPING. DRIP PANS SHALL BE 1.5 TIMES                                                                                                                                   |
| E                                  | THE WIDTH OF THE PIPING SERVED WITH A MINIMUM OF 2" HIGH SIDES.<br>DRIP PANS SHALL BE SUSPENDED FROM THE PIPING SERVED AND SHALL<br>SLOPE AT A MINIMUM 1/8"/FT. DRIP PANS SHALL DISCHARGE WITH MIN.                                                                                                                                           |
| S                                  | 1-1/2" DR TO FLOOR DRAINS.<br>A. DO NOT LOCATE PIPING DIRECTLY ABOVE ANY ELECTRICAL EQUIPMENT                                                                                                                                                                                                                                                 |
| ' IN                               | IN ELECTRICAL ROOMS.         14.       MAINTAIN DESIGNATED PLUMBING FIXTURE HEADER SIZE FOR FULL BANK OF                                                                                                                                                                                                                                      |
| R.                                 | 14. MAIN TAIN DESIGNATED PLUMBING FIXTURE HEADER SIZE FOR FULL BANK OF<br>FIXTURES.<br>15. PROVIDE GAS VENTS EXTENDING CONTINUOUSLY FROM ALL INTERIOR GAS                                                                                                                                                                                     |
| E DUCT.                            | 15. PROVIDE GAS VENTS EXTENDING CONTINUOUSLY FROM ALL INTERIOR GAS<br>REGULATORS TO THE EXTERIOR OF THE BUILDING. TERMINATE AT AN<br>APPROVED LOCATION. SIZE VENTS SUCH THAT MINIMUM VENT SIZE (FOR<br>VENT WHICH IS 10 FEET OR LESS IN LENGTH) EQUALS RELIEF OUTLET PIPE<br>SIZE. INCREASE VENT PIPE SIZE ONE PIPE SIZE FOR EVERY ADDITIONAL |
|                                    | TEN FEET OF VENT PIPE LENGTH. A. PROVIDE AN ISOLATION VALVE DOWNSTREAM OF EVERY INTERIOR GAS                                                                                                                                                                                                                                                  |
|                                    | REGULATOR.                                                                                                                                                                                                                                                                                                                                    |
|                                    | NOT LIMITED TO:                                                                                                                                                                                                                                                                                                                               |
| IICAL                              | <ul><li>A. STORM DRAIN BODIES.</li><li>B. HORIZONTAL STORM LINES ABOVE GROUND AND EXTERIOR TO THE BUILDING.</li></ul>                                                                                                                                                                                                                         |
|                                    | C. SANITARY TRAPS ABOVE GROUND AND EXTERIOR TO THE BUILDING.                                                                                                                                                                                                                                                                                  |
| S.P. LOSS                          | D. DOMESTIC WATER LINES ABOVE GROUND AND EXTERIOR TO THE BUILDING.                                                                                                                                                                                                                                                                            |
|                                    | E. ELSEWHERE AS INDICATED ON THE DRAWINGS OR SPECIFICATIONS. <u>SEISMIC RESTRAINTS:</u>                                                                                                                                                                                                                                                       |
| RAWINGS, AND                       | 1. LOCATE, SELECT, DESIGN AND INSTALL SEISMIC RESTRAINTS FOR ALL<br>MECHANICAL SYSTEMS. INCLUDE RESTRAINTS FOR DUCTWORK, PIPING AND<br>EQUIPMENT.                                                                                                                                                                                             |
| 3                                  | 2. COMPLY WITH THE REQUIREMENTS OF THE "GUIDELINES FOR SEISMIC<br>RESTRAINTS OF MECHANICAL SYSTEMS AND PLUMBING PIPING SYSTEMS",                                                                                                                                                                                                              |
| EMENT BY<br>BY                     | RESTRAINTS OF MECHANICAL SYSTEMS AND PLUMBING PIPING SYSTEMS",<br>CURRENT EDITION, PUBLISHED JOINTLY BY THE SHEET METAL INDUSTRY<br>FUND OF LOS ANGELES, CALIFORNIA AND THE PLUMBING AND PIPING<br>INDUSTRY COUNCIL INC., LOS ANGELES, CALIFORNIA.                                                                                            |
| OLATION                            | 3. REFER TO STRUCTURAL PLANS FOR SEISMIC LOAD DESIGN CRITERIA.<br><u>STRUCTURE:</u>                                                                                                                                                                                                                                                           |
| DS.                                | 1. DO NOT PENETRATE STRUCTURAL MEMBERS. ALL EQUIPMENT SUPPORTS SHALL<br>BE ATTACHED TO THE LOAD BEARING MEMBERS OF STRUCTURAL ELEMENTS.                                                                                                                                                                                                       |
| MING                               | DO NOT OVER-STRESS ANY STRUCTURAL MEMBERS. CONTACT STRUCTURAL<br>ENGINEER FOR ALLOWABLE LOADS FOR SPECIFIC MEMBERS.<br>2. DO NOT UTILIZE POWER DRIVEN ANCHORS FOR ANY LOCATIONS WHICH                                                                                                                                                         |
| TIONS<br>IZE                       | REQUIRE THE LOAD TO BE HELD IN TENSION. SEE STRUCTURAL DIVISION<br>FOR ADDITIONAL RESTRICTIONS.                                                                                                                                                                                                                                               |
| AIR LEAKS                          | 3. SEE ALSO STRUCTURAL DIVISION FOR ACCEPTABLE ANCHORING AND SUPPORT<br>MEANS, METHODS, AND LOCATIONS.                                                                                                                                                                                                                                        |
| GE LINES.                          | 4. PROVIDE FLEXIBLE CONNECTORS, EXPANSION LOOPS, EXPANSION JOINTS,<br>ADDITIONAL FITTINGS OR EQUIVALENT TO ACCOMMODATE THE THERMAL                                                                                                                                                                                                            |
| ND TWO<br>HING<br>C WATER          | EXPANSION OF THE BUILDING THROUGH STRUCTURAL EXPANSION JOINTS.<br>PROVIDE SUCH FITTING AT EVERY PIPE, DUCT, CONDUIT, ETC. CROSSING                                                                                                                                                                                                            |
| C WATER<br>IVE<br>OF NORMAL        | OF A STRUCTURAL EXPANSION JOINT.                                                                                                                                                                                                                                                                                                              |
| ET OF                              | 1. WHERE EXISTING OR NEW MECHANICAL SYSTEMS ARE USED FOR TEMPORARY                                                                                                                                                                                                                                                                            |
| VITHIN THE                         | VENTILATION OR CLIMATE CONTROL, MECHANICAL EQUIPMENT INSTALLER<br>SHALL PROVIDE CONSTRUCTION FILTERS, MAINTAIN EQUIPMENT, AND CLEAN,<br>ADJUST AND PUT IN NEW CONDITION BEFORE BUILDING OCCUPANCY. PARTS                                                                                                                                      |
| N THE<br>ECIFICATIONS)<br>ATE PIPE | AND LABOR WARRANTY SHALL NOT BE CONSIDERED TO START UNTIL ACCEPTANCE OF SYSTEM BY OWNER.                                                                                                                                                                                                                                                      |
| DING                               | 2. PROVIDE CONSTRUCTION FILTERS INSTALLED AT ALL AIR MOVING DEVICES<br>THROUGHOUT THE CONSTRUCTION. REMOVE FILTERS ONLY FOR BALANCING AND<br>FINAL TURNOVER, INSPECT ALL, NON CONSTRUCTION FILTERS AND REPLACE ALL                                                                                                                            |
|                                    | FINAL TURNOVER. INSPECT ALL NON-CONSTRUCTION FILTERS AND REPLACE ALL<br>THOSE DEEMED NECESSARY BY THE ENGINEER PRIOR TO ACCEPTANCE OF THE<br>SYSTEM BY THE OWNER.                                                                                                                                                                             |
|                                    | FINAL TURNOVER. INSPECT ALL NON-CONSTRUCTION FILTERS AND REPLACE ALL THOSE DEEMED NECESSARY BY THE ENGINEER PRIOR TO ACCEPTANCE OF THE                                                                                                                                                                                                        |

|                                       |                                         |         |                                          |                      |          | NOT ALL SYMBOLS                     | CHAN<br>LISTED BELOW                                 |            | AL LEC                                           |          | )<br>Cal dra | WINGS )                               |                |                                       |
|---------------------------------------|-----------------------------------------|---------|------------------------------------------|----------------------|----------|-------------------------------------|------------------------------------------------------|------------|--------------------------------------------------|----------|--------------|---------------------------------------|----------------|---------------------------------------|
| SYM<br>DOUBLE                         | BOL                                     | ABBR    | DESCRIPTION                              | SYMBOL               | ABBR     | DESCRIPTION                         | SYMBOL                                               | ABBR       | DESCRIPTION                                      | SYMBOL   | ABBR         | DESCRIPTION                           | SYMBOL ABBR    | DESCRIPTION                           |
| HVAC:                                 | SINGLE                                  |         |                                          | PIPING:              | (E)      |                                     | VALVES:                                              | GV         | GATE VALVE                                       | SYMBOLS: |              | UNDERCUT DOOR                         | ABBREVIATIONS: |                                       |
|                                       | $\leftarrow$                            |         | RETURN DUCT<br>UP                        | — (E) —              | (=/      | EXISTING PIPING<br>EXISTING PIPING  |                                                      |            | OUTSIDE STEM AND                                 |          | UC           | (UNDER ARCH.<br>SECTION)              | GAL<br>GPH     | GALLON<br>GALLONS PER HOUR            |
|                                       |                                         |         | SUPPLY DUCT                              |                      |          | TO BE REMOVED<br>CONTROL AIR        |                                                      | OS&Y       | YOKE                                             | D/L      | D/L          | DOOR LÓUVER<br>(UNDER ARCH.           | GPM            | GALLONS PER<br>MINUTE                 |
|                                       |                                         |         | UP                                       | A                    | A        | (PNEUMATIC)                         |                                                      | DV         | DRAIN VALVE W/<br>HOSE END CONN.                 |          |              | SECTION)                              | GV             | GRAVITY VENTILATOR,<br>GATE VALVE     |
|                                       | $\leftarrow$                            |         | EXHAUST DUCT<br>UP                       | BD                   | BD       | BOILER BLOW<br>DOWN                 |                                                      |            | BALL VALVE W/<br>HOSE CONNECTION                 |          | L/D          | HEIGHT. (UNDER<br>ARCH. SECTION)      | нс             | HEATING COIL                          |
|                                       |                                         |         |                                          | BF                   | BF<br>BO | BOILER FEED<br>BLOW OFF             |                                                      | cv         | CHECK VALVE WITH<br>INDICATION OF FLOW           | -/       |              | RETURN/ EXHAUST<br>AIR FLOW SYMBOL    | HP             | HORSEPOWER                            |
|                                       |                                         |         | SUPPLY DUCT<br>DOWN                      | CF                   | CF       | CHEMICAL FEEDER                     |                                                      |            | DIRECTION                                        |          |              | SUPPLY AIR<br>FLOW SYMBOL             | HU<br>HZ       | HUMIDIFIER SECTION<br>HERTZ           |
|                                       |                                         |         | RETURN DUCT                              | —PCS—                | PCS      | PROCESS COOLING<br>WATER SUPPLY     |                                                      | PRV        | REDUCING VALVE                                   | ABBREVIA | <br>TIONS:   |                                       | IN. W.C.       | INCH WATER                            |
|                                       |                                         |         | DOWN                                     | —-PCR —-             | PCR      | PROCESS COOLING<br>WATER RETURN     |                                                      | SV         | SOLENOID VALVE                                   | (R)      | (R)          | REMOVE OR<br>RELOCATE                 | ISOL.          | ISOLATOR                              |
|                                       |                                         |         | EXHAUST DUCT                             | —HWS—                | HWS      | HEATING WATER<br>SUPPLY             | FC                                                   | FCV        | AUTO FLOW CONTROL<br>VALVE W/ TEST               | (E)      | (E)          | EXISTING (PAREN-<br>THESIS AROUND     | KW             | KILOWATTS                             |
|                                       |                                         |         | DOWN                                     | —                    | HWR      | HEATING WATER<br>RETURN             |                                                      |            | PORTS<br>CIRCUIT SETTER OR                       |          |              | ITEM INDICATES<br>IT IS EXISTING)     | LBS<br>LBS/HR  | POUNDS<br>POUNDS PER HOUR             |
|                                       | $\langle - \bigcirc \rangle$            |         | ROUND DUCT                               | HTWS-                | HTWS     | HIGH TEMP. HOT                      |                                                      | CS,BV      | BALANCING VALVE                                  | (N)      | (N)          | NEW                                   | LVG.           | LEAVING                               |
|                                       |                                         |         | DOWN                                     | HTWR-                | HTWR     | WATER SUPPLY<br>HIGH TEMP. HOT      | ->>>>                                                | GLV        | GLOBE VALVE<br>(STRAIGHT                         |          | DN<br>AFF    | DOWN<br>ABOVE FIN, FLOOR              | МА             | MAKE-UP AIR                           |
|                                       | -                                       |         | ROUND DUCT<br>UP                         |                      |          | WATER RETURN                        | — <del>—</del> ——————————————————————————————————    |            | PATTERN)<br>GLOBE VALVE                          |          | AFG          | ABOVE FIN. GRADE<br>TOP OF DUCT (AFF) | MAX.           | MAXIMUM<br>MINIMUM CIRCUIT            |
|                                       |                                         |         |                                          | — снѕ —              | CHS      | CHILLED WATER<br>SUPPLY             |                                                      | GLV        | (ANGLE PATTERN)<br>BUTTERFLY                     |          | TOD<br>BOD   | BOT. OF DUCT (AFF)                    | MCA            | AMP                                   |
|                                       | S = 1                                   |         | DUCT DROP                                | — CHR —              | CHR      | CHILLED WATER<br>RETURN             |                                                      | BFV        | VALVE                                            |          | TOP<br>NTS   | TOP OF PIPE (AFF)<br>NOT TO SCALE     | МВН            | THOUSAND BTUH                         |
|                                       | $\langle$                               |         | TRANSITION-RECT.<br>TO RECT. OR ROUND    | —cws—                | CWS      | CONDENSER<br>WATER SUPPLY           |                                                      | BV         | BALL VALVE<br>AUTOMATIC                          |          | AF           | AFTER FILTER                          | MCA<br>MCC     | MIN. CIRCUIT AMPS.<br>MOTOR CONTROL   |
|                                       |                                         |         | TO ROUND                                 | —CWR—                | CWR      | CONDENSER<br>WATER RETURN           |                                                      | тсv        | TEMP. CONTROL<br>VALVE, 2-WAY                    |          | AFF          | ABOVE FINISHED<br>FLOOR               |                | CENTER                                |
|                                       | $\Sigma \rightarrow \Sigma \rightarrow$ |         | TRANSITION-RECT.<br>TO ROUND             | —LPS—                | LPS      | LOW PRESSURE<br>STEAM SUPPLY        |                                                      | тсу        | AUTOMATIC<br>TEMP. CONTROL                       |          | АН           | AIR HANDLING UNIT                     | MIN.           | MINIMUM<br>MAX. OVER CURRENT          |
|                                       |                                         |         | VANED ELBOW                              | MPS                  | MPS      | MEDIUM PRESSURE                     |                                                      |            | VALVE, 3-WAY<br>PLUG VALVE                       |          | AL<br>AMB.   | ALUMINUM<br>AMBIENT                   |                | PROTECTION                            |
|                                       |                                         |         |                                          |                      | HPS      | HIGH PRESSURE<br>STEAM SUPPLY       |                                                      | PV         | TEMPERATURE/                                     |          | AND.         | ACCESS PANEL                          | MTL            | METAL                                 |
|                                       |                                         |         | CAPPED<br>DUCTWORK                       | LPR                  | LPR      | LOW PRESSURE<br>STEAM CONDENSATE    |                                                      | TPR        | PRESSURE<br>RELIEF VALVE                         |          | В            | BOILER                                | MUA            | MAKE-UP AIR UNIT                      |
|                                       |                                         |         | EXISTING                                 |                      |          | RETURN<br>MEDIUM PRESSURE           |                                                      |            | VALVE IN RISER                                   |          | BHP          | BRAKE HORSE<br>POWER                  | OA NC          | OUTSIDE AIR                           |
|                                       | <u> </u> בל                             |         | DUCTWORK NO<br>CHANGE                    |                      | MPR      | STEAM CONDENSATE                    | ۲<br>کې                                              | STR        | STRAINER W/<br>BLOW-OFF<br>& CAPPED HOSE-        |          | BTUH         | BRITISH THERMAL<br>UNIT PER HOUR      | O.C.<br>OPNG   | ON CENTER<br>OPENING                  |
| 777                                   | V ///Л                                  |         | EXISTING                                 |                      | HPR      | MEDIUM PRESSURE<br>STEAM CONDENSATE |                                                      |            | END CONNECTION<br>STEAM TRAP                     |          | CAV          | CONSTANT AIR<br>VOLUME                | P              | PUMP                                  |
| 7114                                  | <i>\\\\\\</i>                           |         | DUCTWORK TO<br>BE REMOVED                |                      |          | RETURN<br>PUMPED CONDENSATE         | _───<br>SYMBOLS:                                     |            | -SECTION NO.                                     |          | сс           | COOLING COIL                          | P.D.           | PRESSURE DROP/<br>DIFFERENTIAL        |
| لــــــــــــــــــــــــــــــــــــ | ل(1L)ل                                  |         | DUCT W/ INTERNAL<br>LINING 1L= 1" THICK  |                      | PR       | RETURN<br>REFRIGERANT               |                                                      |            | SECTION VIEW                                     |          | CFH          | CUBIC FEET PER<br>HOUR                | PF             | PRE-FILTER                            |
|                                       |                                         |         | 2L= 2" THICK                             | RS                   | RS       | SUCTION                             | M                                                    |            | SHEET NO.                                        |          | CFM          | CUBIC FEET PER<br>MINUTE              | PRESS          | PRESSURE                              |
|                                       |                                         | FD      | FIRE DAMPER                              | RL                   | RL       | REFRIGERANT<br>LIQUID               | F                                                    |            | DETAIL<br>DESIGNATION                            |          | СН           | CHILLER                               | PSIG           | POUNDS PER SQUARE                     |
| Ļ <b>₽</b>                            |                                         | SD      | SMOKE DAMPER.<br>CONTROLLED BY DUCT      | RHG                  | RHG      | REFRIGERANT<br>HOT GAS              |                                                      |            | DESIGNATION                                      |          | COP          | COEFFICIENT OF<br>PERFORMANCE         | PWL            | SOUND POWER LEVEL                     |
|                                       | 1 1 1                                   |         | SMOKE DETECTOR                           | DR                   | DR<br>D  | EQUIP. DRAIN<br>INDIRECT DRAIN      | $\left  \begin{array}{c} F \\ 1 \end{array} \right $ | <b>F</b> 1 | EQUIPMENT                                        |          | CRU          | CONDENSATE<br>RETURN UNIT             | QTY.           | QUANTITY<br>RETURN AIR                |
|                                       | L ■CL                                   | SD (C)  | SMOKE DAMPER.<br>CONTROLLED BY           | V                    | V        | VENT                                | F                                                    | <u>F–1</u> | DESIGNATION                                      |          | cv           | CONSTANT VOLUME                       | REF            | REFERENCE                             |
|                                       | 1 1 1                                   |         | CORRIDOR OR AREA<br>SMOKE DETECTOR       | IW                   | IW       | INDUSTRIAL WATER                    |                                                      |            |                                                  |          | dB           | DECIBEL                               | RF             | RETURN FAN                            |
|                                       |                                         | FSD     | FIRE SMOKE DAMPER.<br>CONTROLLED BY DUCT | — SCW —<br>FITTINGS: | SCW      | SOFT COLD WATER                     | <b>`</b>                                             |            | SHEET KEY NOTES                                  |          | DB<br>DDC    | DRY-BULB<br>DIRECT DIGITAL            | RH<br>RLA      | RELATIVE HUMIDITY<br>RUNNING LOAD AMP |
|                                       |                                         |         | SMOKE DETECTOR<br>FIRE SMOKE DAMPER.     | нинса.<br>Ч          | Р&Т      | PRESSURE/<br>TEMPERATURE            |                                                      | POC        | (CONN. NEW TO<br>EXISTING)                       |          |              | CONTROL                               | RPM            | REVOLUTION PER<br>MINUTE              |
|                                       |                                         | FSD (C) | CONTROLLED BY<br>CORRIDOR OR AREA        |                      |          | PORT TAPS                           |                                                      | POD        | POINT OF<br>DISCONNECTION                        |          | DEFL<br>DIA  | DEFLECTION<br>DIAMETER                | RQD            | REQUIRED                              |
|                                       |                                         |         | SMOKE DETECTOR                           |                      | CR       | CONCENTRIC<br>REDUCER               |                                                      |            | AIR DEVICE CALL<br>OUT. TYP. OF (X)              |          | DIA          | DOWN                                  | SA             | SUPPLY AIR                            |
|                                       |                                         | MD      | DAMPER                                   |                      | ER       | ECCENTRIC<br>REDUCER                |                                                      |            | DEVICES.                                         |          | DP           | DISCHARGE PLENUM                      | SCFM           | STANDARD AIR CUBIC<br>FEET PER MINUTE |
| ┟──┞──↓                               | ΓĻ                                      | MVD     | MANUAL VOLUME<br>DAMPER W/ LOCKING       |                      |          | EXPANSION                           |                                                      |            |                                                  |          | DWG<br>EA    | DRAWING<br>EXHAUST AIR                | SF             | SUPPLY FAN                            |
|                                       | 1 1                                     |         | QUADRANT                                 |                      | EJ       | JOINT                               | (E)                                                  | (E) T<br>T | EXIST. THERMOSTAT                                |          | EDR          | EFFECTIVE DIRECT                      | SHT            | SHEET                                 |
|                                       |                                         | BD      | BACKDRAFT<br>DAMPER                      |                      | U        | UNION                               |                                                      |            | NEW THERMOSTAT                                   |          | EER          | RADIATION<br>ENERGY EFFICIENT         | SPECS<br>S.P.  | SPECIFICATIONS<br>STATIC PRESSURE     |
|                                       | <u> </u>                                |         |                                          |                      |          | THERMOMETER                         |                                                      |            | SENSOR                                           |          | EF           | RATIO<br>EXHAUST FAN                  | SQ.            | SQUARE                                |
|                                       |                                         |         | CONICAL TAP                              |                      |          | W/THERMOWELL                        | H                                                    |            | SPACE HUMIDISTAT                                 |          | EFF          | EFFICIENCY                            | SS             | STAINLESS STEEL                       |
| <u>_</u> P                            | Ţ                                       |         | CONICAL SPIN-IN                          |                      | AV       | AIR VENT                            |                                                      |            | SPACE HOMIDITT<br>SENSOR<br>SPACE PRESSURE       |          | ENT          | ENTERING                              | ST<br>TG       | SOUND TRAP<br>TRANSFER GRILLE         |
|                                       |                                         |         | FITTING W/ MANUAL<br>VOLUME DAMPER       |                      | FC       | FLEXIBLE PIPE<br>CONNECTOR          | <u>©</u>                                             |            | SENSOR<br>CARBON DIOXIDE                         |          | ESP          | EXTERNAL STATIC<br>PRESSURE           | TSP            | TOTAL STAIC                           |
|                                       | <br>N                                   |         | SUPPLY DIFFUSER                          |                      | FS       | FLOW SWITCH                         |                                                      |            | SENSOR<br>CARBON MONOXIDE                        |          | F<br>FC      | DEGREE FAHRENHEIT<br>FAN COIL UNIT    | TYP            | PRESSURE<br>TYPICAL                   |
|                                       |                                         |         | SUPPLY DIFFUSER-                         |                      |          | PRESSURE                            |                                                      |            | SENSOR                                           |          | F.G.         | FIBERGLASS                            | UON            | UNLESS OTHERWISE                      |
|                                       | •                                       |         | 4-WAY THROW                              |                      | PS       | SWITCH<br>PRESSURE                  | <u> </u>                                             |            | DUCT MOUNTED<br>SMOKE DETECTOR                   |          | FF           | FINAL FILTER                          | UTR            | UP THROUGH ROOF                       |
|                                       |                                         |         | SUPPLY DIFFUSER-<br>3-WAY THROW          |                      | PG       | GAUGE W/GAUGE                       |                                                      |            | ARROW INDICATES<br>DIRECTION OF FLOW             |          | FLA          | FULL LOAD AMP.                        |                | VARIABLE AIR VOLUME                   |
|                                       |                                         |         | SUPPLY DIFFUSER-<br>2-WAY THROW          | -<br>-               |          | ELBOW UP                            |                                                      |            | RISE IN DIRECTION<br>OF AIRFLOW                  |          | FPI          | FINS PER INCH                         | VEL.<br>VSD    | VELOCITY<br>VARIABLE SPEED            |
|                                       |                                         |         | SUPPLY DIFFUSER-                         | C—                   |          | ELBOW DOWN                          |                                                      |            | DROP IN DIRECTION                                |          | FPM<br>FRIC. | FEET PER MINUTE                       | VTR            | DRIVE<br>VENT THROUGH                 |
|                                       |                                         |         | 1-WAY THROW<br>SUPPLY SLOT               |                      |          | TEE UP                              | <u>DN</u>                                            |            | OF AIRFLOW                                       |          |              | FLASH TANK                            | WB             | ROOF<br>WET-BULB                      |
|                                       |                                         |         | DIFFUSER<br>RETURN AIR                   |                      |          | TEE DOWN                            |                                                      | WL         | EXTERIOR WALL<br>LOUVER (UNDER<br>ARCH. SECTION) |          | FS           | FLOOR SINK                            | WF             | WATER FILTRATION                      |
|                                       |                                         | RA      | GRILLE                                   |                      |          | PIPE CAP OR<br>PLUG                 |                                                      |            |                                                  |          | די. w.C.     | FEET WATER<br>COLUMN                  | W/<br>W/O      | WITH<br>WITHOUT                       |
|                                       |                                         |         | FLEXIBLE DUCT                            |                      |          |                                     |                                                      |            |                                                  |          |              |                                       | w/0            |                                       |
|                                       |                                         | AP      | CEILING ACCESS<br>PANEL                  |                      |          |                                     |                                                      |            |                                                  |          |              |                                       |                |                                       |
| H-~                                   | ~ ~                                     |         | HUMIDIFIER                               |                      |          |                                     |                                                      |            |                                                  |          |              |                                       |                |                                       |
|                                       |                                         |         | FLEXIBLE DUCT<br>CONNECTION              |                      |          |                                     |                                                      |            |                                                  |          |              |                                       |                |                                       |
|                                       | NOTES                                   |         |                                          |                      |          |                                     |                                                      |            |                                                  |          |              |                                       | I              |                                       |
|                                       | I. NEW D                                | UCIWURK | S HEAVY LINE WEIG                        | I AND/UR S           | HAULU.   |                                     |                                                      |            |                                                  |          |              |                                       |                |                                       |
| FIRED VENTIN                          |                                         |         |                                          |                      |          |                                     |                                                      |            |                                                  |          |              |                                       |                |                                       |

GAS FIRED VENTING REQUIREMENTS:

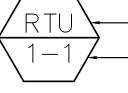
1. ALL FLUES SERVING GAS FIRED EQUIPMENT SHALL BE DOUBLE WALL TYPE "B" BY METALBESTOS CO. OR EQUAL. TERMINATE FLUES A MINIMUM HEIGHT ABOVE ROOF (AS DETERMINED BY CODE) WITH WEATHER CAP. SLOPE HORIZONTAL RUNS TOWARD POINT OF **ORIGINATION AT MINIMUM 1/4" PER 1'.** 

- **ELECTRIC HEAT FREEZE PROTECTION:**
- 1. PIPE HEAT TRACE CABLE:
- A. HEAT TRACE CABLE SHALL BE INSTALLED BY A LICENSED ELECTRICIAN.
- B. APPLY THE HEAT TRACE CABLE ON THE PIPE AFTER PRESSURE

CONDITIONS.

- TESTING.
- (1) DO NOT SPIRAL WRAP ON PIPE.
- (2) MAKE ONE WRAP AT VALVES.
- (3) SECURE TO PIPE WITH METHODS APPROVED BY MANUFACTURER.
- C. APPLY "ELECTRICALLY TRACED" SIGNS ON OUTSIDE OF INSULATION.
- D. TEST PER MANUFACTURER'S RECOMMENDATIONS.
- E. APPLY HEAT TRACE TO THE FOLLOWING PIPING SYSTEMS.
- (1) DOMESTIC WATER (COLD, HOT, RECIRC.) EXPOSED TO FREEZING
- (2) SANITARY TRAPS AND THE DOWNSTREAM HORIZONTAL PIPE WHERE **EXPOSED TO FREEZING CONDITIONS.**
- (3) STORM PIPING SUBJECT TO FREEZING CONDITIONS.
- F. ALL HEAT TRACE PIPE SHALL BE INSULATED PER SPECIFICATIONS. G. COORDINATE ALL HEAT TRACING AND REQUIRED CIRCUITS WITH
- ELECTRICAL CONTRACTOR.

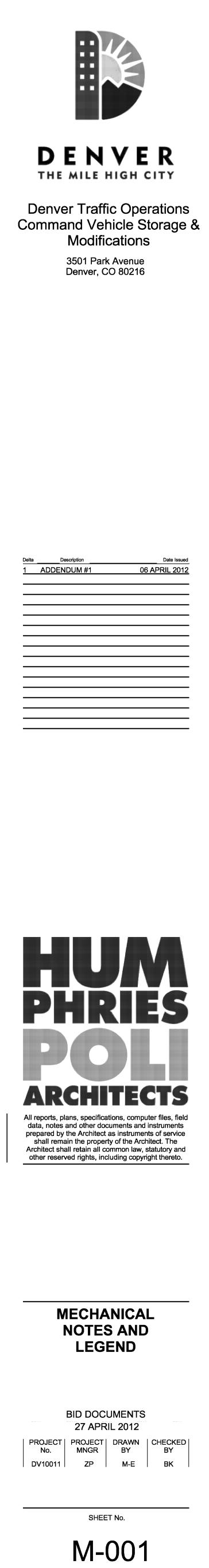
# EQUIPMENT DESIGNATIONS

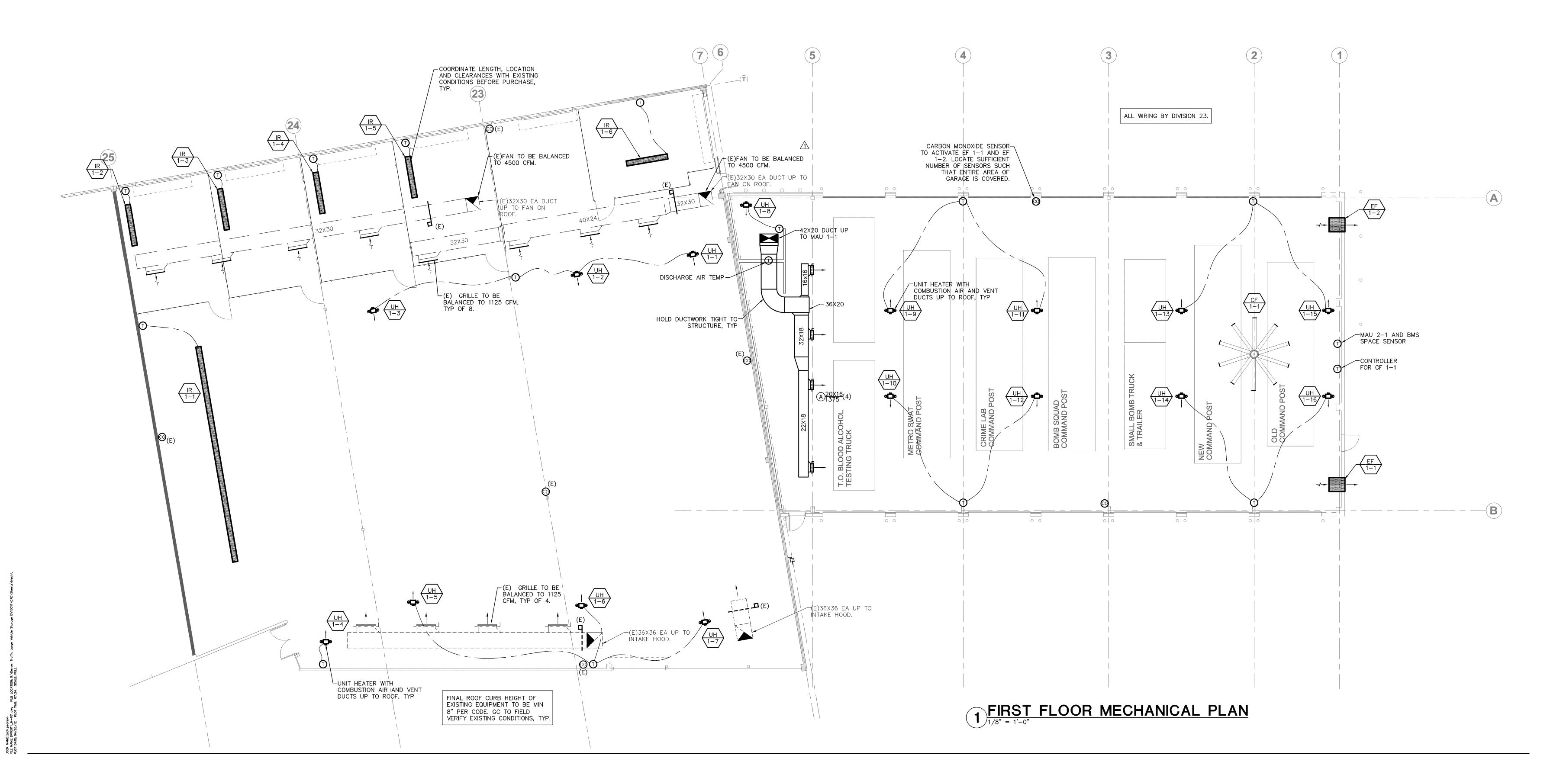


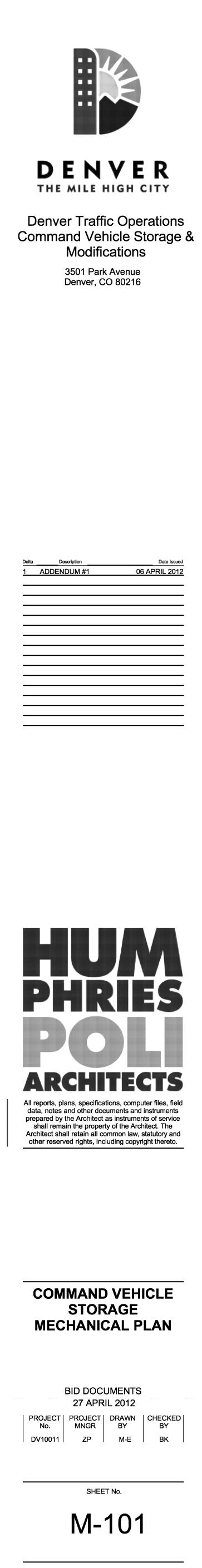
- INDICATES TYPE OF EQUIPMENT - INDICATES UNIT NUMBER WITHIN AREA

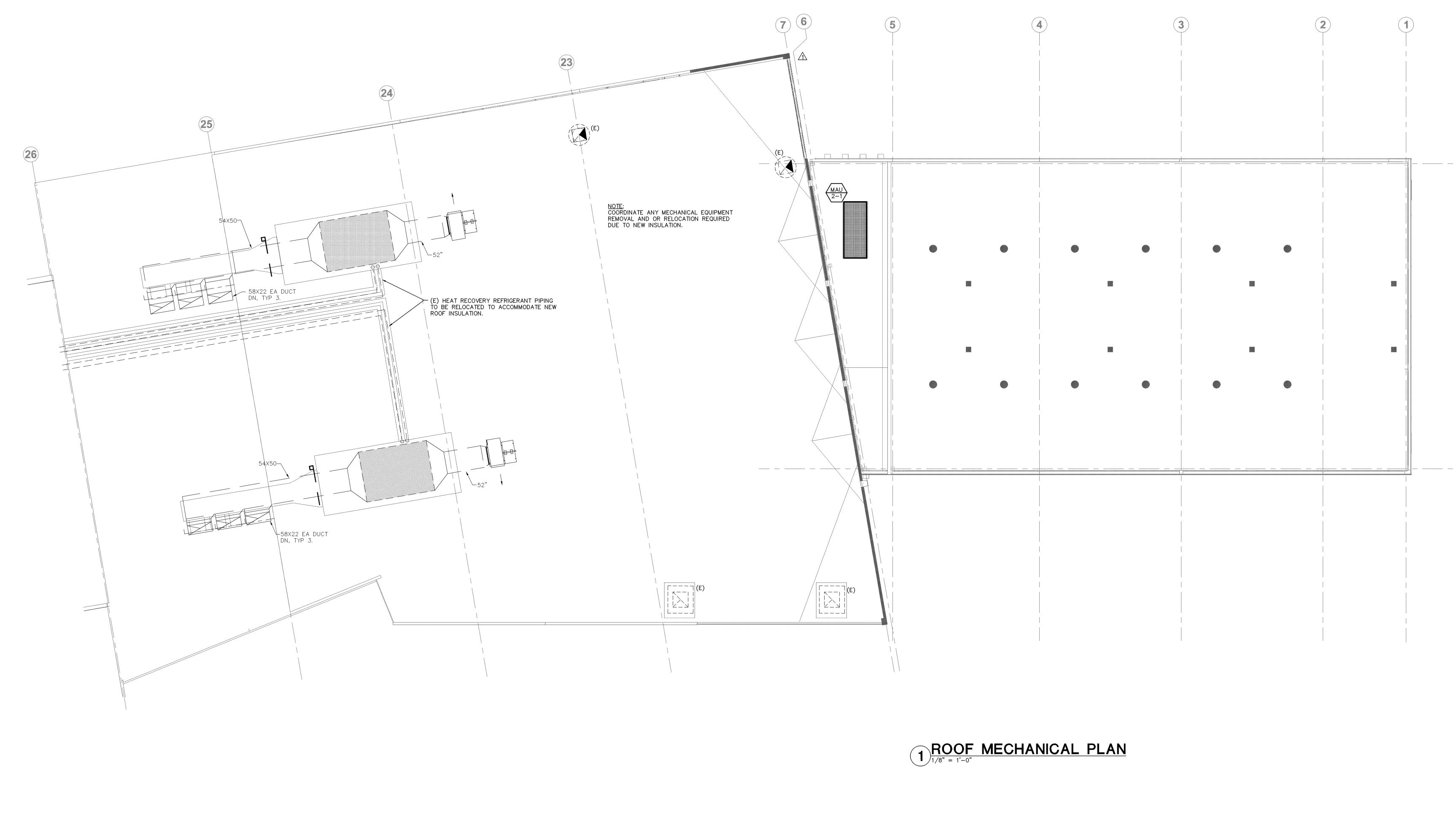
FIRE STOPPING:

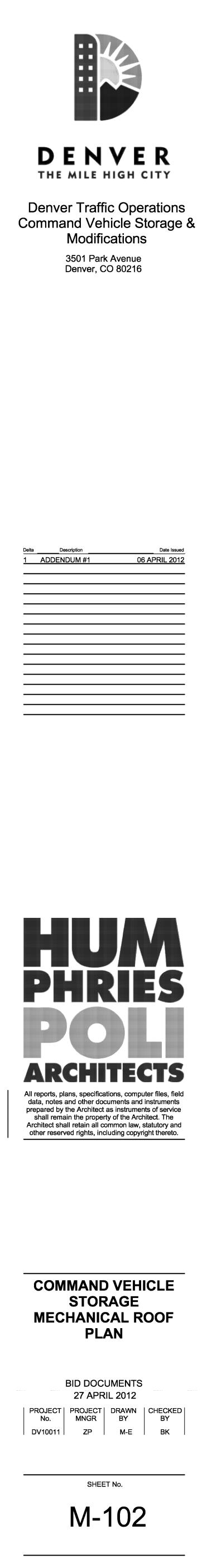
1. FIRE STOPPING REQUIREMENT: PENETRATIONS THROUGH RATED WALLS AND FLOORS SHALL BE SEALED WITH A MATERIAL CAPABLE OF PREVENTING THE PASSAGE OF FLAMES AND HOT GASSES WHEN SUBJECTED TO THE REQUIREMENTS OF THE TEST STANDARD SPECIFIC FOR FIRE STOPS ASTM-E-814. ACCEPTANCE MATERIALS INCLUDE: DOW CORNING RTV FIRE STOP FOAM FOR BARE PIPE, METAL CONDUIT, AND ELECTRICAL CABLE; 3M FIRE DAM 150 CAULK FOR BARE PIPE, METAL CONDUIT, AND BUILDING CONSTRUCTION: GAPS 3M FS-195 INTUMESCENT STRIPS FOR INSULATED PIPES, PLASTIC PIPE OR CONDUIT, AND ELECTRICAL CABLE.











# <u>GENERAL:</u>

- SETPOINT SYSTEMS.

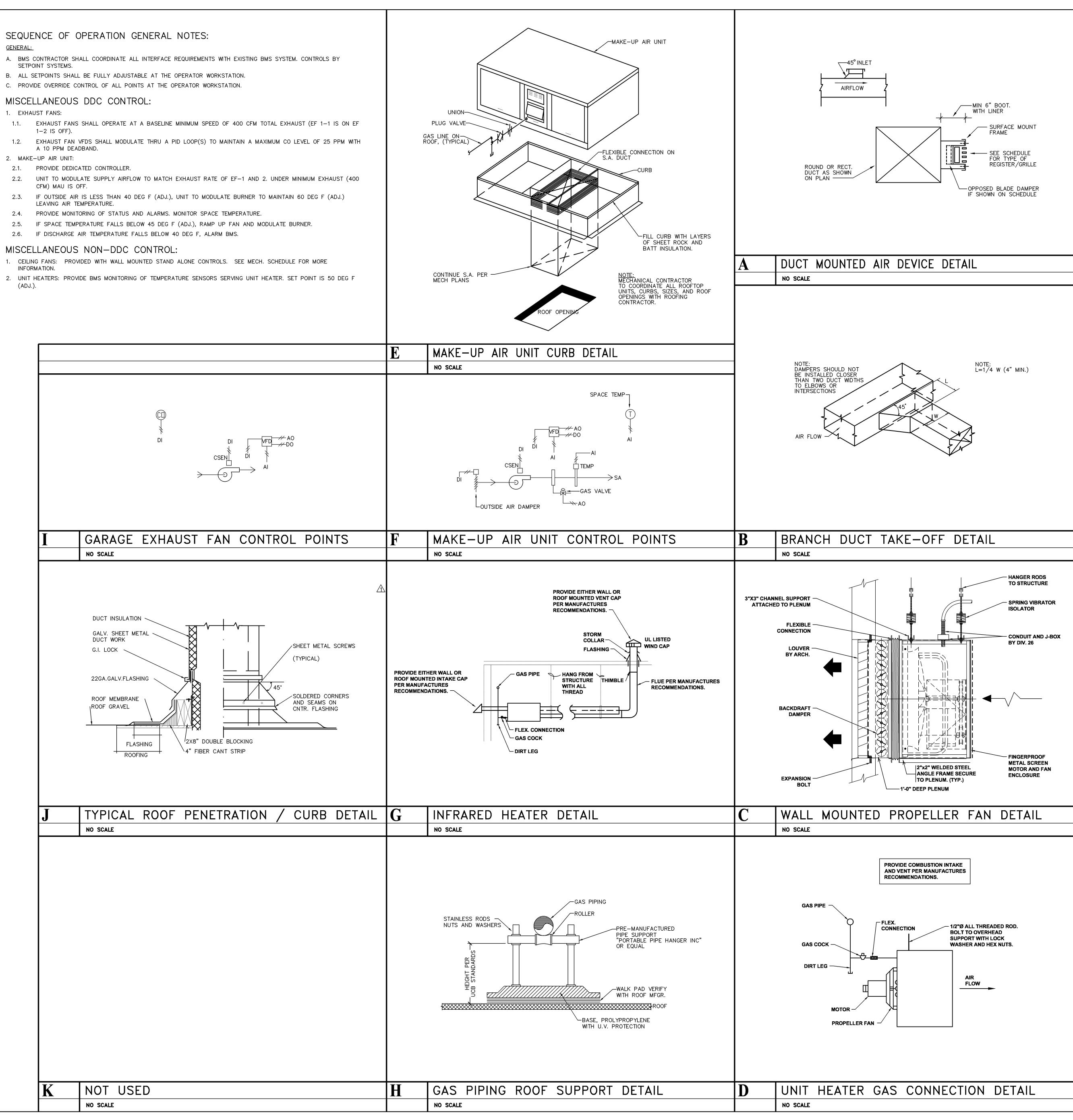
# MISCELLANEOUS DDC CONTROL:

- 1. EXHAUST FANS: 1–2 IS OFF). A 10 PPM DEADBAND. 2. MAKE-UP AIR UNIT: 2.1. PROVIDE DEDICATED CONTROLLER. CFM) MAU IS OFF.
- LEAVING AIR TEMPERATURE.

# MISCELLANEOUS NON-DDC CONTROL:

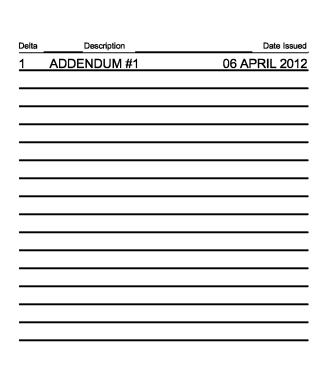
- INFORMATION.
- (ADJ.).

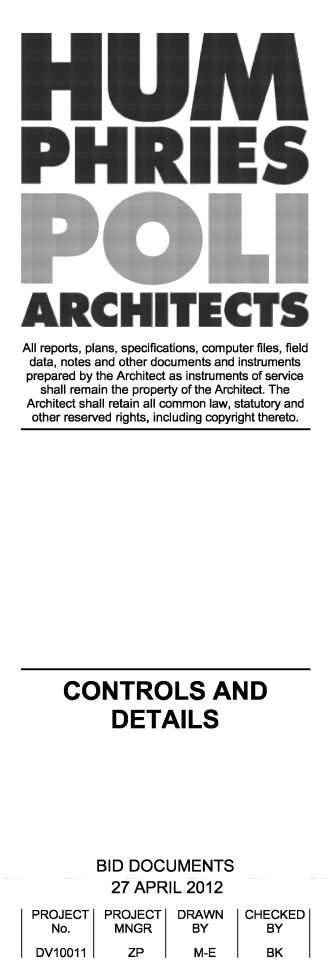
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Denver Traffic Operations Command Vehicle Storage & Modifications 3501 Park Avenue Denver, CO 80216





SHEET No.



| CODE     | MANUFACTURER/                                                                                                                     |              | INPUT | REFLECTOR   | CLI   | EARANCES ( | IN)  |    | ELEC | TRICAL |     |         |
|----------|-----------------------------------------------------------------------------------------------------------------------------------|--------------|-------|-------------|-------|------------|------|----|------|--------|-----|---------|
| (IR)     | MODEL NO.                                                                                                                         | SERVICE      | (MBH) | (FT)        | ABOVE | BELOW      | SIDE | HP | VOLT | PH     | FLA | REMARKS |
| 1–1      | ROBERTS GORDAN VANTAGE II CTH2-125                                                                                                | LOADING DOCK | 125   | 40          | 6     | 77         | 46   |    | 120  | 1      | 5   | A, B, C |
| 1-2      | ROBERTS GORDAN CARIBE CGTH-30                                                                                                     | LOADING DOCK | 30    | 8           | 4     | 36         | 16   |    | 120  | 1      | 1   | А, В    |
| 1-3      | ROBERTS GORDAN CARIBE CGTH-30                                                                                                     | LOADING DOCK | 30    | 8           | 4     | 36         | 16   |    | 120  | 1      | 1   | А, В    |
| 1-4      | ROBERTS GORDAN CARIBE CGTH-30                                                                                                     | LOADING DOCK | 30    | 8           | 4     | 36         | 16   |    | 120  | 1      | 1   | А, В    |
| 1-5      | ROBERTS GORDAN CARIBE CGTH-30                                                                                                     | LOADING DOCK | 30    | 8           | 4     | 36         | 16   |    | 120  | 1      | 1   | А, В    |
| 1-6      | ROBERTS GORDAN CARIBE CGTH-30                                                                                                     | LOADING DOCK | 30    | 8           | 4     | 36         | 16   |    | 120  | 1      | 1   | Α, Β    |
| . PROVIC | NOTES<br>TE ELEVATION = 5,300 FT.<br>DE SHIELDING FOR EXISTING EQUIPMENT, PIPING, E<br>NATE MOUNTING AND CLEARANCES WITH EXISTING |              |       | CLEARANCES. | L     |            | L    | L  | 1    | I      | 11  |         |

B. PROVIDE THERMOSTATS AND CONTROL PANELS (24V). C. 40 FOOT STRAIGHT TUBE.

<u> /1</u>

| CODE                    |                      |
|-------------------------|----------------------|
| EF 1-1                  | G                    |
| EF 1-2                  | G                    |
| CF 1-1                  | BIG AS               |
|                         |                      |
|                         | NOTES                |
| 1. DRIVE<br>B=F         | TYPE: D=<br>BELT-PRO |
| 3. SCHED                |                      |
|                         | RATION /             |
|                         | E MAGNE<br>VED FRO   |
| 5. PROVID               |                      |
|                         |                      |
| MOUNTING<br>1. UNIT T   |                      |
| 2. PROVID               |                      |
|                         |                      |
|                         |                      |
| I. FAN OP<br>II. CONTRO |                      |
|                         |                      |
| REMARK N                |                      |
| A. PROVIC<br>B. PROVIC  |                      |
| C. PROVID               |                      |
|                         |                      |
|                         |                      |
|                         |                      |

|         |                              | MAKE UF | P AIR | UNIT        | SCHED      | ULE (GAS      | )  |      |         |     |         |
|---------|------------------------------|---------|-------|-------------|------------|---------------|----|------|---------|-----|---------|
|         | MANUFACTURER/                | AREA    |       | ESP         | CAPA       | CITY (MBH)    |    | ELEC | CTRICAL |     |         |
| CODE    | MODEL NO.                    | SERVED  | CFM   | (ALT.)(IN.) | INPUT (SL) | OUTPUT (ALT.) | HP | VOLT | PH      | FLA | REMARKS |
|         |                              |         |       |             |            |               |    |      |         |     |         |
| MAU 2-1 | REZNOR RPBL-700              | GARAGE  | 5,500 | 0.5         | 700        | 441           | 3  | 480  | 3       | _   | A, B, C |
|         |                              |         |       |             |            |               |    |      |         |     |         |
|         | IOTES<br>FULL PERIMETER ROOF |         |       |             |            |               |    |      |         |     |         |

PROVIDE PREMIUM EFFICIENCY MOTORS FOR MOTORS 1 HP AND OVER PER MENA STANDARD MG1-2003, TABLES 12-12 AND 12-13.
 PROVIDE DUCT SMOKE DETECTOR IN ALL UNITS OVER 2000 CFM. RE: SPECIFICATIONS

4. PROVIDE FILTER SECTION WITH MERV 8 FILTERS.

5. PROVIDE VFD. 6. SCHEDULED FAN VALUES (CFM, SP AND HP) ARE ACTUAL AT ALTITUDE. MOTOR HP HAS BEEN ADJUSTED FROM SEA LEVEL CONDITIONS FOR OPERATION AT JOBSITE ELEVATION. JOBSITE ELEVATION = 5300FT.

REMARK NOTES

A. PROVIDE INTAKE HOOD WITH SCREEN, DOWNTURN PLENUM, INTAKE DAMPER, RELAY CONTACTS TO START EF, INSULATED CABINET AND 120V CONVINENCE OUTLET.

B. UNIT TO HAVE 4:1 TURNDOWN RATIO. . PROVIDE VFD AND MODULATING BURNER

 $\triangle$ 

| CODE | MANUFACTURER/    |           | INPUT | OUTPUT |       | EAT | LAT |     | ELECT | RICAL |    |
|------|------------------|-----------|-------|--------|-------|-----|-----|-----|-------|-------|----|
| (UH) | MODEL NO.        | SERVICE   | (MBH) | (MBH)  | CFM   | (F) | (F) | HP  | MCA   | VOLT  | PH |
| 1–1  | REZNOR / MODEL B | GARAGE    | 165   | 104    | 2,715 | 50  | 110 | 1/2 | 9     | 120   | 1  |
| 1-2  | REZNOR / MODEL B | GARAGE    | 165   | 104    | 2,715 | 50  | 100 | 1/2 | 9     | 120   | 1  |
| 1–3  | REZNOR / MODEL B | GARAGE    | 165   | 104    | 2,715 | 50  | 100 | 1/2 | 9     | 120   | 1  |
| 1-4  | REZNOR / MODEL B | GARAGE    | 165   | 104    | 2,715 | 50  | 100 | 1/2 | 9     | 120   | 1  |
| 1-5  | REZNOR / MODEL B | GARAGE    | 165   | 104    | 2,715 | 50  | 100 | 1/2 | 9     | 120   | 1  |
| 1–6  | REZNOR / MODEL B | GARAGE    | 165   | 104    | 2,715 | 50  | 100 | 1/2 | 9     | 120   | 1  |
| 1–7  | REZNOR / MODEL B | GARAGE    | 165   | 104    | 2,715 | 50  | 100 | 1/2 | 9     | 120   | 1  |
| 1–8  | REZNOR / MODEL B | WORK AREA | 100   | 63     | 1,645 | 50  | 100 | 1/3 | 5.3   | 120   | 1  |
| 1–9  | REZNOR / MODEL B | GARAGE    | 100   | 63     | 1,645 | 50  | 110 | 1/3 | 5.3   | 120   | 1  |
| 1–10 | REZNOR / MODEL B | GARAGE    | 100   | 63     | 1,645 | 50  | 100 | 1/3 | 5.3   | 120   | 1  |
| 1–11 | REZNOR / MODEL B | GARAGE    | 100   | 63     | 1,645 | 50  | 100 | 1/3 | 5.3   | 120   | 1  |
| 1–12 | REZNOR / MODEL B | GARAGE    | 100   | 63     | 1,645 | 50  | 100 | 1/3 | 5.3   | 120   | 1  |
| 1–13 | REZNOR / MODEL B | GARAGE    | 100   | 63     | 1,645 | 50  | 100 | 1/3 | 5.3   | 120   | 1  |
| 1–14 | REZNOR / MODEL B | GARAGE    | 100   | 63     | 1,645 | 50  | 100 | 1/3 | 5.3   | 120   | 1  |
| 1–15 | REZNOR / MODEL B | GARAGE    | 100   | 63     | 1,645 | 50  | 100 | 1/3 | 5.3   | 120   | 1  |
|      | REZNOR / MODEL B | GARAGE    | 100   | 63     | 1,645 | 50  | 100 | 1/3 | 5.3   | 120   | 1  |

# ENVIRONMENTAL FAN SCHEDULE

|                                | · · · · · · · · · · · · · · · · · · · |          |           |       |        | -     |      |         |     |     |      |         |
|--------------------------------|---------------------------------------|----------|-----------|-------|--------|-------|------|---------|-----|-----|------|---------|
|                                |                                       |          |           |       | ESP    |       | E    | ELECTRI | CAL |     |      |         |
| MANUFACTURER/                  |                                       |          |           |       | "W.C.  |       |      |         |     |     |      |         |
| MODEL NO.                      | SERVICE                               | LOCATION | TYPE      | CFM   | (ALT.) | DRIVE | HP/W | VOLT    | PH  | MTG | CTRL | REMARKS |
| GREENHECK SBE-2H20             | GARAGE EXHAUST                        | GARAGE   | PROPELLER | 2,750 | 0.35   | В     | 1/2  | 120     | 1   | 1   |      | А, В    |
| GREENHECK SBE-2H20             | GARAGE EXHAUST                        | GARAGE   | PROPELLER | 2,750 | 0.35   | В     | 1/2  | 120     | 1   | 1   | _    | А, В    |
|                                |                                       |          |           |       |        |       |      |         |     |     |      |         |
| BIG ASS FANS / 14' POWERFOIL X | GARAGE DESTRATIFICATION               | GARAGE   | PROPELLER | —     | —      | D     | 1.5  | 460     | 3   | 2   | П    | С       |
|                                |                                       |          |           |       |        |       |      |         |     |     |      |         |

PE: D=DIRECT-PROVIDE RHEOSTAT SPEED CONTROLLER IN FAN HOUSING UNLESS OTHERWISE NOTED. T-PROVIDE ADJUSTABLE SHEAVE UNLESS OTHERWISE NOTED.

ED FAN VALUES (CFM, SP AND HP) ARE ACTUAL AT ALTITUDE. MOTOR HP HAS BEEN ADJUSTED FROM SEA LEVEL CONDITIONS FOR

TION AT JOBSITE ELEVATION. JOBSITE ELEVATION = 5300FT. MAGNETIC STARTER WITH AUXILIARY CONTACTS AND HOA SWITCH ON ALL THREE PHASE UNITS EXCEPT WHEN

D FROM MOTOR CONTROL CENTER. PREMIUM EFFICIENCY MOTORS FOR MOTORS 1 HP AND OVER PER MENA STANDARD MG1-2003, TABLES 12-12 AND 12-13.

MTG) E MOUNTED TO GARAGE WALL.

MANUFACTURER APPROVED MOUNTING SYSTEM. COORDINATE FINAL HEIGHT WITH ARCH.

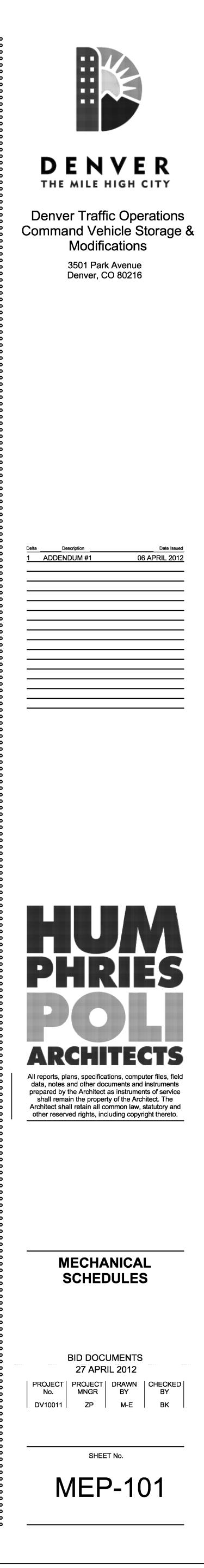
RATED BY CARBON MONOXIDE SENSOR. VIA FACTORY PROVIDED COMPACT WALL SWITCH WITH ABILITY TO ADJUST FAN SPEED. EACH FAN SHALL BE PROVIDED WITH ITS OWN CONTROLLER.

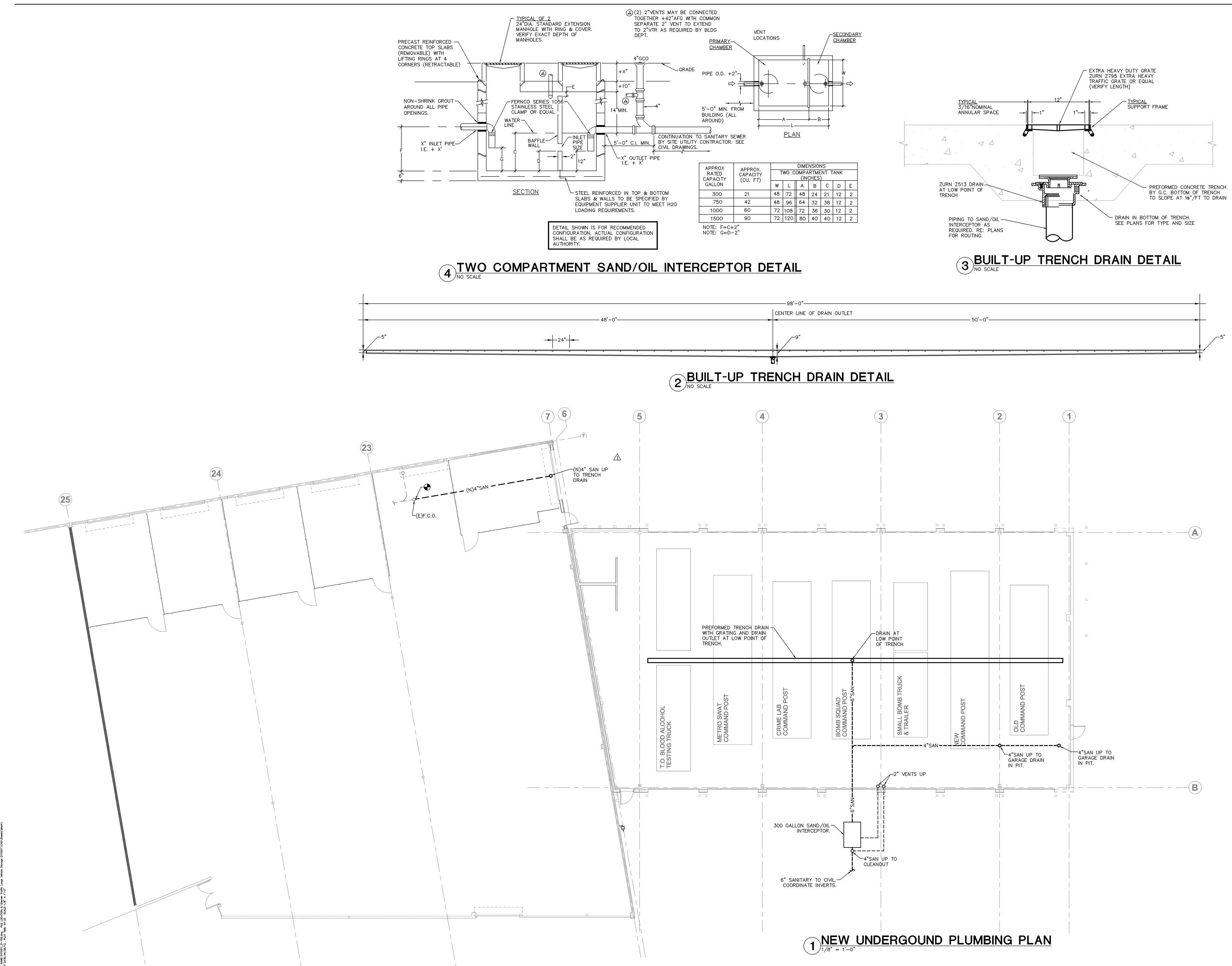
BELT AND MOTOR GUARD.

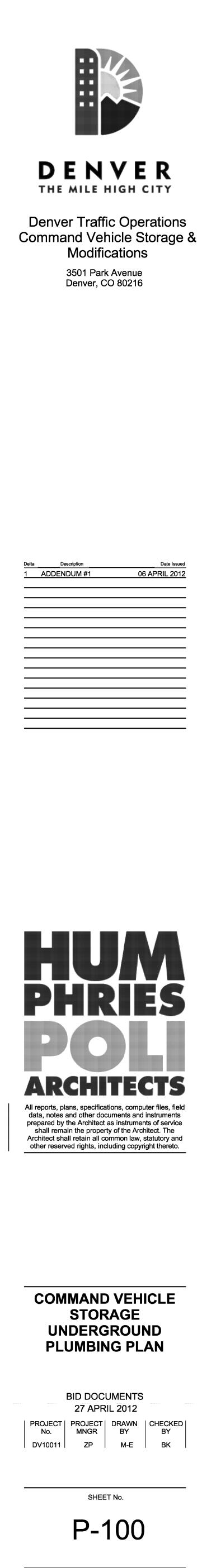
VFD, SHORT MOTOR HOUSING, FLUSH EXTERIOR W / OSHA GUARD, AND GRAVITY BACKDRAFT DAMPER. WITH MANUFACTURER PROVIDED WALL MOUNTED CONTROLLER. CONTROL WIRING BETWEEN CONTROLLER AND FAN SHALL BE BY DIVISION 26.

|                                        | GRILLE REGISTER DIFFUSER SCHEDULE                                                                                                                |                                                 |          |             |           |         |  |  |  |  |  |  |  |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|----------|-------------|-----------|---------|--|--|--|--|--|--|--|
| CODE                                   | MANUFACTURER/<br>MODEL NO.                                                                                                                       | SERVICE                                         | TYPE     | ACCESSORIES | FACE SIZE | REMARKS |  |  |  |  |  |  |  |
| Α                                      | PRICE / 520                                                                                                                                      | SUPPLY                                          | LOUVERED | _           | SEE PLANS | A       |  |  |  |  |  |  |  |
| 2. MAXIMUM<br>3. COLOR T<br>4. MATERIA | OTES<br>NS FOR CFM AND NECK SIZ<br>M NOISE CRITERIA (NC) SHAI<br>TO BE COORDINATED WITH A<br>L IS STEEL UNLESS OTHERW<br>BALANCING DEVICE FOR AL | L BE 30 UNLESS OTHER<br>RCHITECT.<br>ISE NOTED. |          |             |           |         |  |  |  |  |  |  |  |

REMARK NOTES A. ALUMINUM CONSTRUCTION







|        |                                         |                                                                                                          |                 |              |                    | PLUM               | BING FIXTU     | JRE SCHEDULE                        |                    |                                                                             |
|--------|-----------------------------------------|----------------------------------------------------------------------------------------------------------|-----------------|--------------|--------------------|--------------------|----------------|-------------------------------------|--------------------|-----------------------------------------------------------------------------|
| CODE   | FIXTURE                                 | DESCRIPTION                                                                                              | LOCATION        | MIN CW CONN. | MIN HW CONN.       | MIN SAN CONN.      | MIN VENT CONN. | MANUFACTURER & MODEL NO.            | FAUCET/FLUSH VALVE | REMARKS                                                                     |
| GD-1   | GARAGE DRAIN                            | FLOOR DRAIN                                                                                              | ELECTRICAL PITS |              |                    | AS NOTED           |                | ZURN Z509-Z-P-Y WITH C.I. GRATE     |                    | D.C.C.I. BODY, GALV. C.I. GRATE                                             |
| TD-1   | TRENCH DRAIN                            | BUILT-UP TRENCH DRAIN                                                                                    | GARAGE          |              | SIZES              | AS NOTED           |                | ZURN Z794 GRATING / ZURN Z513 DRAIN |                    | H20 LOADING REQUIREMENT FOR TENCH AND GRATE                                 |
| TD-2   | TRENCH DRAIN                            | TRENCH DRAIN                                                                                             | GARAGE          | _            | _                  | 4"                 | _              | JAY R. SMITH ENVIRO-FLO SERIES 9931 |                    | PRE-SLOPED SECTIONS WITH 4" OUTLET AND H20 LOADING REQ. FOR TRENCH AND GRAT |
| WH-1   | WALL HYDRANT                            | RECESSED, MODERATE CLIMATE                                                                               | GARAGE          | 3/4"         |                    |                    |                | ZURN Z1330                          |                    | ANTI-SIPHON, OPERATING KEY LOCK, AUTO DRAINING, INTEGRAL BACKFLOW PREVENTER |
|        |                                         |                                                                                                          |                 |              |                    |                    |                |                                     |                    |                                                                             |
|        |                                         |                                                                                                          |                 |              |                    |                    |                |                                     |                    |                                                                             |
| ALL EX | ING DESIGN AND SIZ<br>POSED PIPING SERV | ZES ARE BASED ON THE 2009 INTERNATION<br>ING PLUMBING FIXTURES THAT MAY BE USE<br>NLESS OTHERWISE NOTED. |                 |              | PLIES INSULATED PE | R ADA REQUIREMENTS | ).             |                                     |                    |                                                                             |

WO – WALL OUTLET

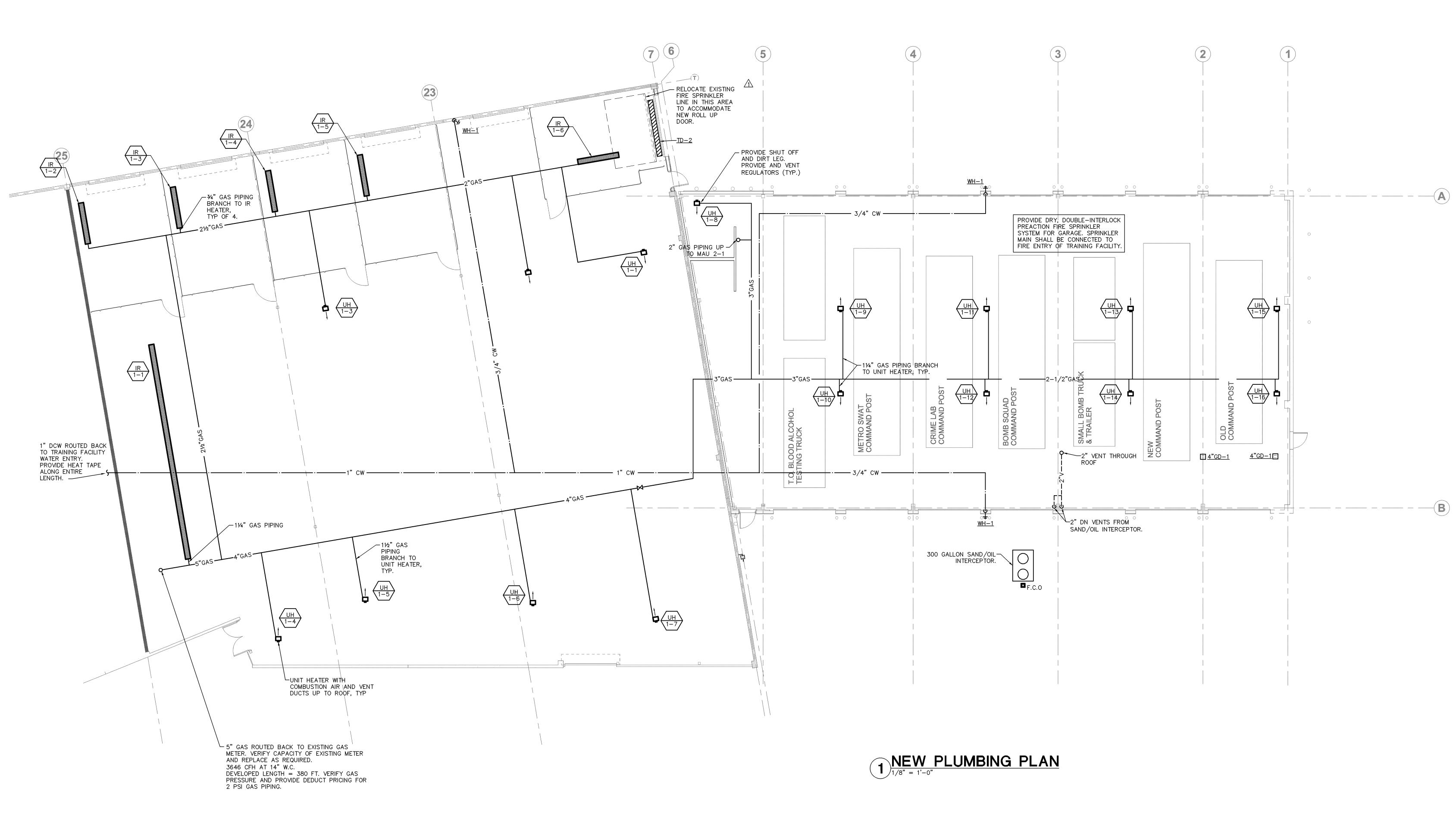
FP – FREEZE PROOF

FV – FLUSH VALVE

FT – TANK

FR - FLOW RESTRICTOR

| DEFINITIONS:                                    |
|-------------------------------------------------|
| ADA – AMERICANS WITH DISABILITIES ACT APPROVED  |
| AS – ANTISCALD                                  |
| BO – BOTTOM OUTLET                              |
| CT – COUNTER TOP                                |
| EB – ELONGATED BOWL                             |
| EBF - ELECTRONIC, BATTERY OPERATED FAUCET       |
| EBFV - ELECTRONIC, BATTERY OPERATED FLUSH VALVE |
| FC — FLASHING CLAMP                             |
| FM – FLOOR MOUNTED                              |



MF – METERING FAUCET PB – PRESSURE BALANCING

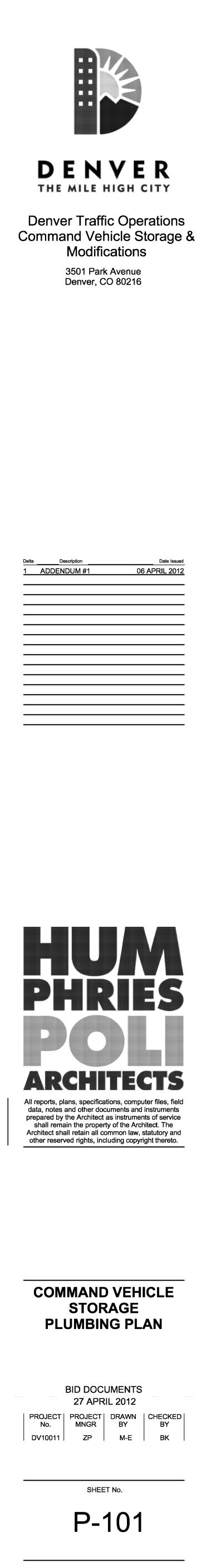
PTB – PRESSURE – TEMPERATURE BALANCED

PES – PORCELAIN ENAMELED STEEL

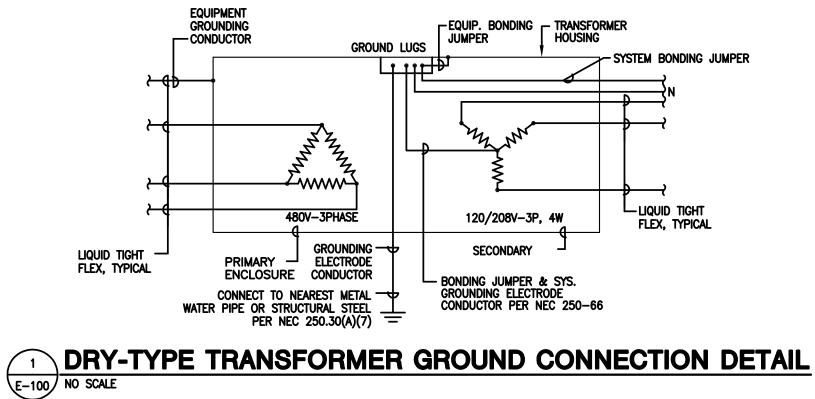
S – SOLID WHITE ELONGATED OPEN FRONT SEAT, LESS COVER WITH CHECK HINGE SC – SOLID WHITE ELONGATED OPEN FRONT SEAT WITH COVER SS – STAINLESS STEEL

VB – VACUUM BREAKER VC – VITREOUS CHINA

VR – VANDAL RESISTANT

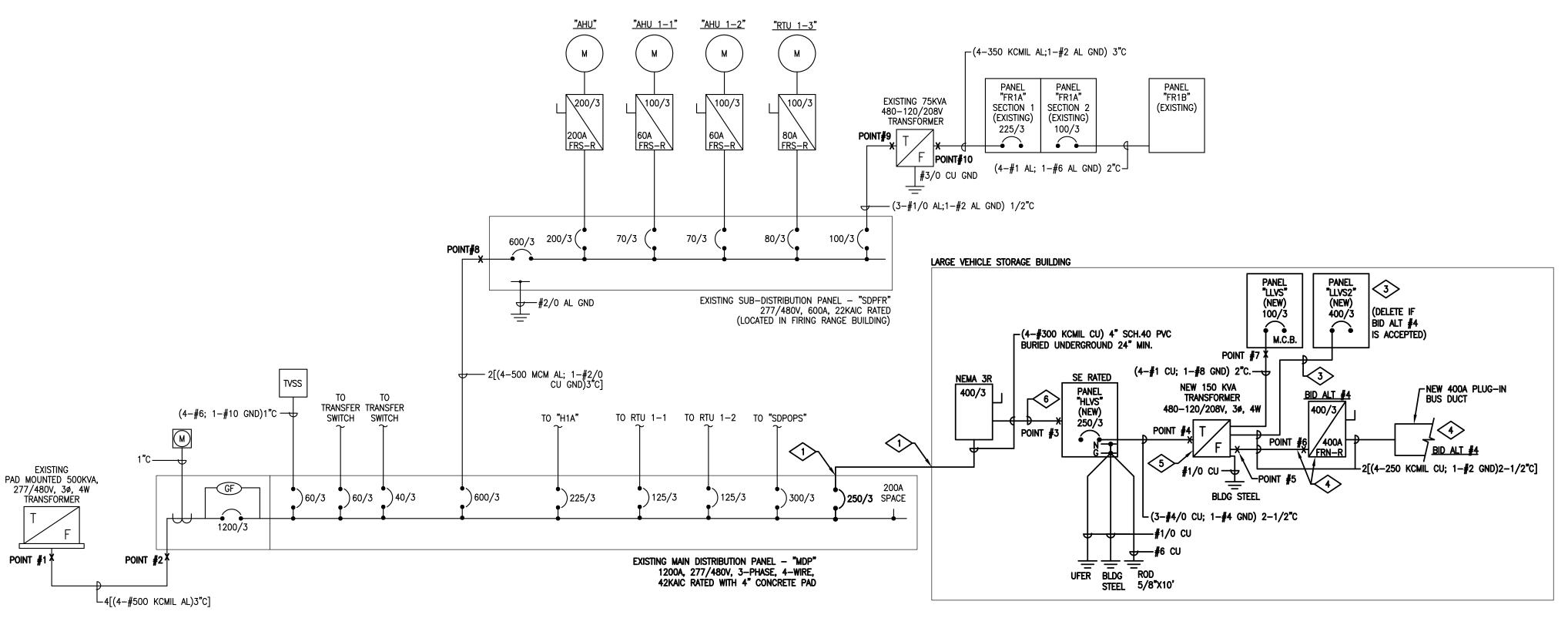


| 1.  | ELECTRICAL CONTRACTOR SHALL FULLY COORDINATE WITH OWNER REPRESENTATIVES. ALL<br>ELECTRICAL WORK PERFORMED UNDER THIS CONTRACT SHALL CONFORM WITH LATEST EDITIONS<br>OF THE NATIONAL ELECTRICAL CODE, INTERNATIONAL BUILDING CODE, LOCAL BUILDING AND FIRE                                                                                                                                                                                                                                                        | POINT #1, AT THE UTILITY TRANSF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2   | DEPARTMENT REQUIREMENTS. PERFORM WORK IN ACCORDANCE WITH REQUIREMENTS OF OWNER<br>REPRESENTATIVES.<br>ELECTRICAL CONTRACTOR SHALL MAINTAIN ON THE JOB AN UP TO DATE SET OF WORKING                                                                                                                                                                                                                                                                                                                               | POINT #2, AT THE MAIN DISTRIBUT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|     | DRAWINGS, MARKED UP TO SHOW ELECTRICAL SYSTEMS AS INSTALLED. PROVIDE TENANT<br>REPRESENTATIVES WITH ONE SET OF REPRODUCIBLES WITH "AS BUILT" PROJECT RECORD<br>INFORMATION CLEARLY INDICATED. ELECTRICAL CONTRACTOR SHALL OBTAIN AND PAY FOR ALL<br>LOCAL FEES, PERMITS, AND SERVICES OF INSPECTION AUTHORITIES REQUIRED BY ELECTRICAL<br>WORK FOR THIS ELECTRICAL CONSTRUCTION.                                                                                                                                 | $f = 1.73 x \text{ Length } x \text{ lsc}$ $f = 1.73 x \underline{110} x $ $f = 0.18$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 3.  | REFER TO ARCHITECTURAL AND MECHANICAL EQUIPMENT DRAWINGS FOR EXACT LOCATIONS OF<br>ELECTRICAL DEVICES AND LIGHT FIXTURES. DO NOT SCALE FROM THE ELECTRICAL PLANS.<br>ADDITIONAL ELECTRICAL REQUIREMENTS ON ARCHITECTURAL PLANS, KITCHEN EQUIPMENT PLANS,<br>AND MECHANICAL PLANS SHALL BE INCLUDED IN THE ELECTRICAL CONTRACTOR'S BID.                                                                                                                                                                           | M = 1/1 + f = 1/1 +                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 4.  | THE ELECTRICAL DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL ARRANGEMENT OF<br>ELECTRICAL WORK. LOCATIONS ARE APPROXIMATE AND SHALL BE SUBJECT TO MINOR<br>MODIFICATIONS AS DIRECTED BY THE GENERAL CONTRACTOR AND OWNER REPRESENTATIVES.<br>ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE EXACT FITTING OF ALL MATERIALS,                                                                                                                                                                             | isc = M x isc (source) =<br>POINT #3, AT PANEL "HLVS";                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|     | EQUIPMENT, ETC., IN THE BUILDING AND TENANT SPACE. ALL DIMENSIONS SHALL BE VERIFIED ON<br>THE JOB. ELECTRICAL CONTRACTOR SHALL CUT, CHANNEL, CHASE, AND/OR DRILL FLOORS, WALLS,<br>PARTITIONS, CEILINGS, OR OTHER SURFACES AS REQUIRED FOR INSTALLATION, SUPPORT,<br>ANCHORAGE, ETC., OF WORK. PROVIDE X-RAY OF FLOOR PRIOR TO CORE DRILLS.                                                                                                                                                                      | f = 1.73 x Length x Is<br>f = 1.73 x 440 x                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|     | PROVIDE COMPLETE AND ACCURATE TYPED PANELBOARD CIRCUIT DIRECTORIES AT THE<br>COMPLETION OF WORK. CLEAN EXPOSED PANEL BOARD SURFACES AND CHECK TIGHTNESS OF<br>ELECTRICAL CONNECTIONS.<br>ALL WALL MOUNTED OUTLETS SHALL BE OFFSET SO THEY ARE NOT BACK TO BACK. A                                                                                                                                                                                                                                                | $f = \frac{2.70}{M} = \frac{1}{1+f} = \frac{1}{1+\frac{1}{1$ |
|     | HORIZONTAL DISTANCE OF AT LEAST 6 INCHES SHALL SEPARATE OUTLET BOXES ON OPPOSITE<br>SIDES OF WALLS AND PARTITIONS. IN SOUND SENSITIVE AREAS, 12" MINIMUM SEPARATION IS<br>REQUIRED. GANG MOUNT ELECTRICAL AND COMMUNICATIONS OUTLETS ON WALLS AS CLOSE<br>TOGETHER AS POSSIBLE.                                                                                                                                                                                                                                  | lsc = M x lsc (source) =                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 7.  | FIRE RESISTIVE WALLS AND OPENINGS MAY HAVE OPENINGS FOR STEEL ELECTRICAL OUTLET<br>BOXES NOT EXCEEDING 16 SQUARE INCHES IN AREA, PROVIDED THE AGGREGATE AREA OF SUCH<br>OPENINGS IS NOT MORE THAN 100 SQUARE INCHES FOR ANY 100 SQUARE FEET OF WALL.                                                                                                                                                                                                                                                             | POINT #4, AT THE 112.5 KVA TR<br>f = $1.73 \times$ Length x is                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|     | ALL WIRING SHALL BE COPPER. #12 AWG MINIMUM, TYPE THHN OR THWN INSULATION. PROVIDE WIRE COLOR CODING AS REQUIRED BY THE NATIONAL ELECTRICAL CODE.<br>ALL WIRING SHALL BE RUN CONCEALED AND IN EMT CONDUIT. ALL HOMERUNS SHALL BE IN EMT                                                                                                                                                                                                                                                                          | $f = 1.73 x 4 x _{f}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|     | CONDUIT. ELECTRICAL CONTRACTOR SHALL OBTAIN WRITTEN APPROVAL FROM ENGINEER FOR<br>USE OF "MC" AND "AC" TYPE CABLING IN "HOME RUN" APPLICATIONS. "MC" AND "AC" TYPE CABLE<br>WITH INTERNAL GROUND WIRES SHALL BE PERMITTED FOR BRANCH CIRCUIT WIRING IN LOCATIONS<br>APPROVED BY THE ARCHITECT AND/OR OWNER ONLY AND INSTALLED PER NATIONAL ELECTRICAL CODE<br>AND LOCAL BUILDING DEPARTMENT REQUIREMENTS. USE LISTED AND APPROVED TYPE COUPLINGS                                                                 | M = 1 / 1 + f = 1 / 1 +i $Isc = M x Isc (source) =i$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 10. | AND CONNECTORS. PROVIDE CONDUIT SUPPORTS AS REQUIRED BY THE NATIONAL ELECTRICAL CODE<br>AS A MINIMUM. ALL EMPTY CONDUITS SHALL BE SUPPLIED WITH PULL WIRES AND BUSHINGS.<br>VOLTAGE DROP: THE ELECTRICAL CONTRACTOR SHALL ENSURE THAT VOLTAGE DROP FOR FEEDERS                                                                                                                                                                                                                                                   | POINT #5, THROUGH THE 112.5K                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|     | TO DISTRIBUTION EQUIPMENT DOES NOT EXCEED 2% AND VOLTAGE DROP IN BRANCH CIRCUITING<br>DOES NOT EXCEED 3% FOR OVERALL VOLTAGE DROP OF 5% (MAXIMUM). FEEDERS LISTED ON<br>SCHEDULES AND THE ELECTRICAL ONE—LINE DIAGRAM ARE A BASE FEEDER/BRANCH CIRCUIT SIZE<br>AND SHALL BE ADJUSTED AS NEEDED BASED ON ACTUAL LENGTHS OF CONDUCTORS.                                                                                                                                                                            | f = [lp x Vp x].73 $f = [-7607 A x] / 100000 x$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|     | ALL JUNCTION BOX COVERS SHALL BE INDELIBLY LABELED WITH PANEL DESIGNATION AND<br>BRANCH CIRCUIT NUMBER OF EACH WIRE WITHIN THE JUNCTION BOX. ALL HOME RUNS SHALL BE IN<br>EMT CONDUIT.<br>NEUTRALS, RACEWAYS, AND NON-CURRENT CARRYING PARTS OF ELECTRICAL EQUIPMENT AND                                                                                                                                                                                                                                         | $f = \frac{1.26}{M}$ $M = 1/1+f = 1/1+$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 12. | ASSOCIATED ENCLOSURES SHALL BE GROUNDED IN FULL ACCORDANCE WITH THE NATIONAL<br>ELECTRICAL CODE. PROVIDE HARD WIRED GROUND CONNECTIONS TO ALL DEVICES AND<br>SEPARATE INSULATED GROUND WIRE CONTINUOUS IN EACH CIRCUIT (#12 CU MINIMUM "GREEN"<br>TRACER GROUND).                                                                                                                                                                                                                                                | Is = (Vp / Vs) x M<br>Is = ( <u>480</u> V /_                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|     | ALL LIGHT FIXTURES SHALL BE SUPPORTED INDEPENDENTLY FROM STRUCTURE. REFER TO<br>ARCHITECTURAL PLANS FOR EXACT LOCATIONS OF LIGHT FIXTURES AND ELECTRICAL DEVICES.                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 14. | ELECTRICAL CONTRACTOR SHALL COORDINATE EXACT LOCATIONS OF LIGHTING FIXTURES IN<br>MECHANICAL ROOMS/SPACES WITH MECHANICAL DUCT WORK INSTALLER PRIOR TO ROUGH IN.<br>LOCATE BELOW DUCT WORK (8'-0" A.F.F. MIN.) CENTERED IN ROOM AS MUCH AS POSSIBLE.<br>ELECTRICAL CONTRACTOR SHALL FIELD VERIFY ALL MECHANICAL EQUIPMENT LOCATIONS AND<br>REQUIREMENTS WITH MECHANICAL PLANS, MECHANICAL CONTRACTOR, AND ACTUAL MECHANICAL<br>EQUIPMENT SUPPLIED. INCLUDE ALL REQUIRED OUTLETS; HEAVY DUTY DISCONNECT SWITCHES, | POINT #6, AT THE FUSED DISCON<br>f = 1.73 x Length x ls<br>$f = 1.73 x _ 5 x _$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 15. | FUSES, CONTROLS, CONTROL WIRING AND ALL CONNECTIONS IN THE ELECTRICAL BID.<br>VERIFY ALL SPECIFIC KITCHEN AND BREAK ROOM EQUIPMENT REQUIREMENTS WITH EQUIPMENT<br>SUPPLIER PRIOR TO ROUGH IN. COORDINATION SHALL INCLUDE MOUNTING HEIGHTS,                                                                                                                                                                                                                                                                       | $f = 0.01$ $M = 1/1+f = 1/1+_{-}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 16. | CONNECTION TYPE AND POWER REQUIREMENTS. ALL CONNECTIONS FOR KITCHEN EQUIPMENT<br>SHALL BE IN ACCORDANCE WITH EQUIPMENT MANUFACTURER'S AND SUPPLIER'S<br>VERIFY ALL SPECIFIC COMPUTER AND COMMUNICATIONS EQUIPMENT REQUIREMENTS WITH<br>EQUIPMENT SUPPLIER PRIOR TO ROUGH IN. COORDINATION SHALL INCLUDE MOUNTING HEIGHTS,                                                                                                                                                                                        | lsc = M x lsc (source) =                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 47  | CONNECTION TYPE AND POWER REQUIREMENTS. ALL CONNECTIONS FOR COMPUTER AND COMMUNICATIONS EQUIPMENT SHALL BE IN ACCORDANCE WITH EQUIPMENT MANUFACTURER'S AND SUPPLIER'S RECOMMENDATIONS.                                                                                                                                                                                                                                                                                                                           | POINT #7, AT PANEL "LLVS";<br>f = 1.73 x Length x ls                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 17. | ALL LIGHT SWITCHES, POWER OUTLETS, TELEPHONE OUTLETS, FIRE ALARM DEVICES, AND<br>COMMUNICATIONS OUTLETS SHALL MEET THE REQUIREMENTS FOR AMERICANS WITH DISABILITIES<br>(A.D.A.) MOUNTING HEIGHTS AND ORIENTATIONS, TYPICAL UNLESS OTHERWISE NOTED.<br>RECEPTACLES SHALL BE A MINIMUM OF 15" A.F.F. AND SWITCHES A MAXIMUM OF 48" A.F.F. TO<br>CENTERLINE, TYPICAL UNLESS OTHERWISE NOTED.                                                                                                                        | $f = 1.73 \times 10 \times 10$ $f = 0.09$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 18. | COORDINATE MOUNTING HEIGHTS AND LOCATIONS OF ALL ELECTRICAL DEVICES LOCATED WITHIN,<br>ABOVE, OR NEAR MILLWORK WITH ARCHITECTURAL DRAWINGS, APPROVED "SHOP DRAWINGS", AND<br>MILLWORK CONTRACTOR. MAINTAIN CONSISTENT MOUNTING PRACTICES FOR A UNIFORM<br>APPEARANCE. VERIFY ALL OUTLET REQUIREMENTS PRIOR TO ROUGH IN.                                                                                                                                                                                          | $M = 1 / 1 + f = 1 / 1 +{lsc}$ $Isc = M \times Isc (source) =$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 19. | PROVIDE 4" SQUARE (DOUBLE GANG) JUNCTION BOX WITH SINGLE GANG PLASTER RING FOR ALL<br>NEW COMBINATION TELEPHONE/DATA OUTLETS. STUB 3/4" EMPTY CONDUIT UP TO 6" ABOVE<br>ACCESSIBLE CEILING WITH PULL WIRE IN CONDUIT AND PLASTIC BUSHINGS ON CONDUIT ENDS.                                                                                                                                                                                                                                                       | POINT #8, AT PANEL "SDPFR";<br>f = 1.73 x Length x Is                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 20. | TENANT COMMUNICATION'S SYSTEM VENDOR UNDER SEPARATE CONTRACT SHALL PROVIDE ALL<br>COMMUNICATION DEVICES AND WIRING. COORDINATE EXACT REQUIREMENTS AND OUTLET<br>LOCATIONS WITH ARCHITECTURAL PLANS PRIOR TO ROUGH IN.<br>ELECTRICAL CONTRACTOR SHALL FULLY FIELD COORDINATE COMMUNICATIONS SYSTEM                                                                                                                                                                                                                | $f = 1.73 \times 260 \text{ GeV} \times 10^{-1} \text{ GeV}$ $f = 1.73 \times 375 \times 600 \text{ GeV}$ $f = 0.90 \times 10^{-1} \text{ GeV}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|     | INSTALLATION (DEVICES AND CABLING) WITH TENANT REPRESENTATIVES PRIOR TO ROUGH-IN AND PURCHASING OF MATERIALS.<br>FIRE ALARM DEVICES INDICATED ON THE ELECTRICAL PLANS ARE APPROXIMATE AND SHALL                                                                                                                                                                                                                                                                                                                  | M = 1/1 + f = 1/1 +                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 22. | BE VERIFIED BY THE ELECTRICAL CONTRACTOR'S FIRE ALARM SUBCONTRACTOR AS REQUIRED<br>BY GENERAL NOTE 24. THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR ALL ROUGH—INS<br>AND CONDUIT REQUIRED BY THE FINAL FIRE ALARM SHOP DRAWINGS.<br>THE ELECTRICAL CONTRACTOR SHALL PROVIDE FULLY ENGINEERED FIRE ALARM SHOP DRAWINGS                                                                                                                                                                                            | ISC = M x ISC (Source) =<br>POINT #9, AT THE 75 KVA TRANS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|     | FOR REVIEW BY THE LOCAL BUILDING AND FIRE DEPARTMENT. INCLUDE ALL AMENDMENTS FROM<br>THE DENVER FIRE ALARM CODE. THE FIRE ALARM SHOP DRAWINGS SHALL BE SIGNED AND SEALED<br>BY A PROFESSIONAL ENGINEER LICENSED BY THE STATE IN WHICH THE PROJECT IS LOCATED.                                                                                                                                                                                                                                                    | f = 1.73 x Length x ls<br>$f = 1.73 x$ _ 4 x _                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|     | MINIMUM WORKING CLEARANCES PER THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE<br>SHALL BE PROVIDED AROUND AND IN FRONT OF ALL ELECTRICAL EQUIPMENT.<br>ALL CIRCUIT BREAKER LUGS SHALL BE RATED FOR A MINIMUM OF 75 DEGREE CELSIUS.                                                                                                                                                                                                                                                                           | $f = 0.02$ $M = 1/1+f = 1/1+_{-}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 25  | ALL NEW MULTI-WIRE BRANCH CIRCUITS SHALL INCLUDE SEPARATE NEUTRAL CONDUCTORS OR TIE BREAKERS AS REQUIRED BY 2008 NEC SECTION 210.4 (B)                                                                                                                                                                                                                                                                                                                                                                           | lsc = M x lsc (source) =                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | POINT #10, THROUGH THE 75KV/<br>$f = \begin{bmatrix} ln & Vn & 173 \end{bmatrix}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | $f = [lp x Vp x1.73]$ $f = [14719 A x] / 100000 x _ f = 4.89$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | $M = 1/1+f = 1/1+_{-}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Is = (Vp / Vs) x M<br>Is = (480 V /                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |



|                                                                                          | _ |
|------------------------------------------------------------------------------------------|---|
| LCULATION                                                                                |   |
| RANSFORMER;                                                                              | 1 |
| = <u>33,400</u> A                                                                        |   |
| RIBUTION PANEL;                                                                          | ┥ |
| x Isc (source) / L—L Volts x Wire Factor                                                 |   |
| x <u>33400</u> A / <u>480</u> x <u>75020</u>                                             |   |
| + 0.18 = 0.85                                                                            |   |
|                                                                                          |   |
| <u>0.85</u> x <u>33400</u> A = <u>28,389</u> A                                           |   |
|                                                                                          |   |
| x lsc (source) / L—L Volts x Wire Factor<br>x <u>28389</u> A <u>/ 480</u> x <u>16673</u> |   |
|                                                                                          |   |
| + =                                                                                      |   |
| <u>0.27</u> x <u>28389</u> A = <u>7,672</u> A                                            |   |
| A TRANSFORMER;                                                                           |   |
| x Isc (source) / L—L Volts x Wire Factor                                                 |   |
| x <u>7672</u> A <u>/ 480</u> x <u>12843</u>                                              |   |
| + 0.01 = 0.99                                                                            |   |
|                                                                                          |   |
| <u>0.99</u> x <u>7672</u> A = <u>7,607</u> A                                             |   |
| 2.5KVA TRANSFORMER;                                                                      |   |
| 1.73 x %Z ⋛ 100,000 x KVA<br>x 480 V x 1.73 x 3.00                                       |   |
| 4 <u>150</u> KVA                                                                         |   |
| ± 126 - 044                                                                              |   |
| + <u>1.26</u> = <u>0.44</u>                                                              |   |
| M x = Ip A / 208 V) x 0.44 x 7607 A                                                      |   |
| ls = 7,756 A                                                                             |   |
|                                                                                          |   |
| SCONNECT;                                                                                |   |
| x Isc (source) / L–L Volts x Wire Factor<br>x <u>7756</u> A <u>/ 208</u> x <u>32966</u>  |   |
|                                                                                          |   |
| + 0.01 = 0.99                                                                            |   |
| <u>0.99</u> x <u>7756</u> A = <u>7,681</u> A                                             |   |
|                                                                                          |   |
| k lsc (source) / L-L Volts x Wire Factor                                                 |   |
| x <u>7756</u> A <u>/ 208</u> x <u>7292</u>                                               |   |
| + 0.09 = 0.92                                                                            |   |
| $0.92 \times 7756 A = 7,126 A$                                                           |   |
|                                                                                          |   |
| <b>*</b> ;                                                                               |   |
| x lsc (source) / L–L Volts x Wire Factor<br>x <u>28389</u> A <u>/ 480</u> x <u>42780</u> |   |
|                                                                                          |   |
| + 0.90 = 0.53                                                                            |   |
| <u>0.53</u> x <u>28389</u> A = <u>14,966</u> A                                           |   |
| RANSFORMER;                                                                              | ┥ |
| x Isc (source) / L—L Volts x Wire Factor                                                 |   |
| x <u>14966</u> A <u>/ 480</u> x <u>12843</u>                                             |   |
| + 0.02 = 0.98                                                                            |   |
|                                                                                          |   |
| <u>0.98</u> x <u>14966</u> A = <u>14,719</u> A                                           |   |
| 5KVA TRANSFORMER;                                                                        |   |
| 1.73 x %Z ϔ 100,000 x KVA<br>x <u>480 V x 1.73 x 3.00</u>                                |   |
| x <u>480</u> v <u>x 1.75</u> x <u>5.00</u><br>x <u>75</u> KVA                            |   |
|                                                                                          |   |
| + 4.89 = 0.17                                                                            |   |
| M x = Ip A / 208 V) x 0.17 x 14719 A                                                     |   |
|                                                                                          |   |
| ls = 5,768 A                                                                             |   |
|                                                                                          |   |

|                       | ECTRICAL SYMBOLS LEGEND                                          |          |                               |
|-----------------------|------------------------------------------------------------------|----------|-------------------------------|
| POW                   | /ER SYMBOLS                                                      |          | FIXTURE SYMBOLS               |
| J                     | FLOOR MOUNTED JUNCTION BOX                                       |          | SURFACE/PENDANT MOUNTED F     |
| 0                     | CEILING MOUNTED JUNCTION BOX                                     |          | SURFACE/PENDANT MOUNTED F     |
| Q                     | WALL MOUNTED JUNCTION BOX                                        |          | SURFACE MOUNTED 1' x 4' FLU   |
| φ                     | SIMPLEX RECEPTACLE                                               |          | SURFACE MOUNTED 1' x 4' FLU   |
| Φ                     | DUPLEX RECEPTACLE                                                | 0        | SURFACE MOUNTED 2' x 4' FLU   |
| •                     | DEDICATED DUPLEX RECEPTACLE                                      |          | RECESS MOUNTED 2' x 4' FLU    |
| Ф                     | CEILING MOUNTED DUPLEX RECEPTACLE                                |          | RECESS MOUNTED 2 X + FLO      |
| <b>#</b>              | CEILING MOUNTED FOURPLEX RECEPTACLE                              |          | RECESS MOUNTED 2' x 4' FLU    |
| ₱                     | FOURPLEX RECEPTACLE                                              |          | RECESS MOUNTED 1' x 4' FLU    |
| <b>†</b>              | DEDICATED FOURPLEX RECEPTACLE                                    |          | RECESS MOUNTED 1' x 4' FLU    |
| $\mathbf{\nabla}$     | SPECIAL RECEPTACLE - SEE DRAWING NOTES                           | ••       | PENDANT MOUNTED FIXTURE (LI   |
| $\bigcirc$            | CEILING-MOUNTED SPECIAL RECEPTACLE/DROP CORD - SEE DRAWING NOTES | <u> </u> | CEILING MOUNTED SINGLE FACE E |
| R                     | FUSED HEAVY DUTY DISCONNECT SWITCH                               | ⊗        | WALL MOUNTED SINGLE FACE E    |
|                       | MOTOR                                                            | ±<br>i€i | CEILING MOUNTED DOUBLE FACE   |
| •••                   | ONE, TWO, and THREE BUTTON PUSH SWITCH                           |          | WALL MOUNTED DOUBLE FACE I    |
|                       | PULL BOX                                                         | ±<br>8   | POLE MOUNTED FLOOD LIGHT      |
|                       | TIME CLOCK                                                       | Q        |                               |
| C                     | CONTACTOR                                                        | ¥        | WALL MOUNTED FIXTURE          |
| C/T                   | CURRENT TRANSFORMER                                              |          | TRACK LIGHTING                |
| $\mathbf{O}$          | METER                                                            |          | TRACK LIGHTING FIXTURE        |
|                       | PANEL BOARD                                                      | 역        | SINGLE ARM SITE LIGHTING - A  |
| <b>√</b> <sub>F</sub> | TRANSFORMER                                                      | H_]      | BUILDING EXTERIOR WALL MOUN   |
|                       |                                                                  | S        | SWITCH, SINGLE POLE           |
|                       |                                                                  | S2       | SWITCH, DOUBLE POLE           |
| CIRC                  | CUITING SYMBOLS                                                  | S3       | SWITCH, THREE WAY             |
| <u> </u>              | ■ CIRCUITING DESIGNATION – OPEN 277/480 VOLT, SOLID 120/208 VOLT | S4       | SWITCH, FOUR WAY              |
|                       | _ CIRCUITING - RUN CONCEALED IN WALL OR CEILING                  | Sd       | SWITCH, DIMMER                |
|                       | _ CIRCUITING - RUN CONCEALED IN FLOOR OR GRADE                   | Sĸ       | SWITCH, KEYED                 |
| <b></b> •_            | $_{ullet}$ conduit riser — Turned UP, Turned Down                | Sp       | SWITCH, WITH PILOT LIGHT      |
|                       | ے CIRCUITING - CONTINUED AS DESIGNATED                           | STO      | SWITCH, THERMAL OVERLOAD      |
|                       | - CIRCUITING - END CAP                                           | Sv       | SWITCH, VOLUME CONTROL        |
| ⊢ wм -                | -<br>H wiremold as specified on plans                            | Ì        | CEILING MOUNTED OCCUPANCY     |
|                       |                                                                  | ŚM       | WALL MOUNTED OCCUPANCY SE     |



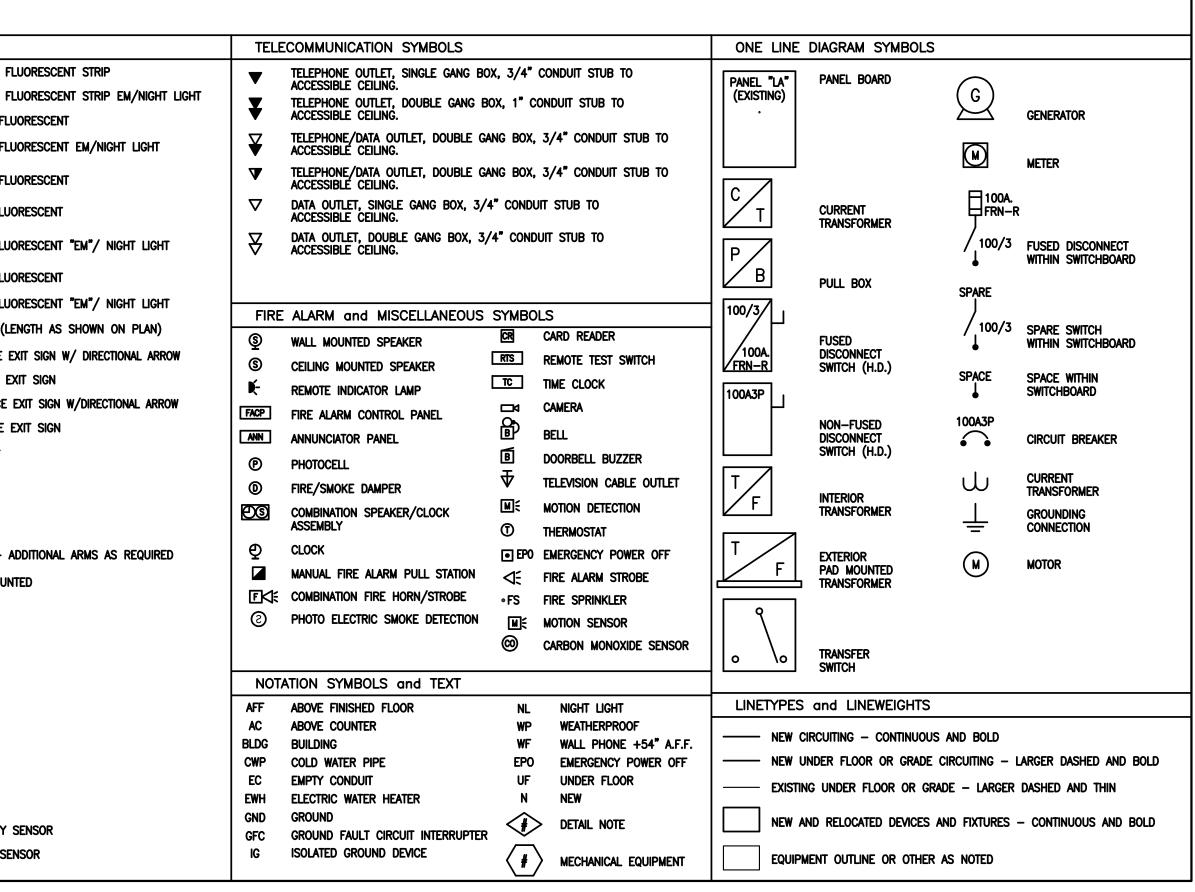
## PARTIAL NEW ONE-LINE DIAGRAM NO SCALE

GENERAL NOTES: A. NEW AND RELOCATED ITEMS SHOWN AS BOLD \_\_\_\_\_\_ EXISTING ITEMS SHOWN AS LIGHT \_\_\_\_\_

# **DETAIL NOTES**

1. TRANSITION FROM RIGID NON-METALLIC CONDUIT TO GRC AT THE STUB-UP POINT FROM UNDERGROUND INTO THE VEHICLE STORAGE BUILDING. NOTE: IF CONDUIT IS EXPOSED AT THE EXTERIOR OF THE MAIN ELECTRICAL ROOM, PROVIDE GRC FROM STUB-OUT POINT INTO TRENCH ENTRANCE AND TRANSITION TO RIGID NON-METALLIC CONDUIT FOR ALL UNDERGROUND CONDUIT.

- 2. NOT USED. 3. BASE BID: PROVIDE NEW 400A FEEDER AND PANEL AS SHOWN FOR CORD DROPS. IF BID ALTERNATE #4 IS ACCEPTED, THIS PANEL
- AND FEEDER ARE TO BE DELETED. 4. <u>BID ALTERNATE #4</u>: PROVIDE NEW 400A FEEDER, DISCONNECT AND BUSWAY AS SHOWN AND AS DESCRIBED ON E-300 FOR CORD DROPS.
- 5. PROVIDE 150KVA TRANSFORMER WITH 220-DEGREE C RATED INSULATION.
- 6. PROVIDE CONDUCTORS SIZED AS SPECIFIED, BUT TRANSITION FROM RIGID NON-METALLIC CONDUIT TO GRC AT BUILDING ENTRANCE.

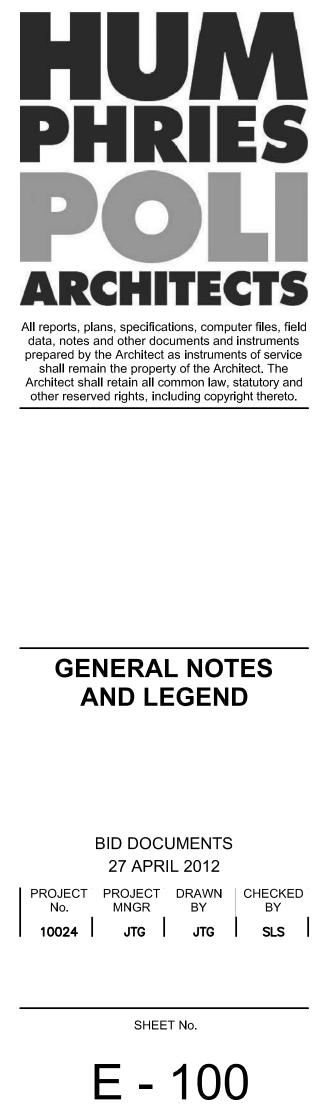


# SUMMARY OF ELECTRICAL ALTERNATES

- PROJECT ALTERNATE #4: REFERENCED ON THESE PLANS AS <u>BID ALTERNATE #4</u>. 1.1. <u>ALTERNATE PRICING</u> SHALL CONSIST OF THE INSTALLATION OF A 400-AMP PLUG-IN STYLE BUSWAY AND CIRCUIT-BREAKER STYLE DISTRIBUTION POINTS FOR OVERHEAD OUTLETS IN 1.1. THE VEHICLE STORAGE AREA. 1.1.1. THE ALTERNATE DISTRIBUTION IS DEPICTED ON THE PLANS AND THE ONE-LINE DIAGRAM. 1.1.2. IF THE ALTERNATE IS ACCEPTED, THE BASE-BID PANEL "LLVS2" DESCRIBED BELOW, AS WELL AS THE BRANCH CIRCUIT HOME RUNS TO THIS PANEL, SHALL BE OMITTED FROM PROJECT SCOPE. 1.2. <u>BASE BID</u> SHALL CONSIST OF THE INSTALLATION OF A 400-AMP PANEL "LLVS2" TO SERVE THE OVERHEAD OUTLETS IN THE VEHICLE STORAGE AREA.
- 1.2.1. THIS PANEL IS SHOWN ON THE ONE-LINE DIAGRAM AND DESCRIBED BUT NOT DEPICTED ON THE FLOORPLANS. REFER TO THE SCHEDULE ON SHEET E-200. 1.2.2. CIRCUIT NUMBER ASSIGNMENTS ARE SHOWN ADJACENT TO EACH OVERHEAD RECEPTACLE BUT HOME RUNS ARE OMITTED FOR CLARITY.
- PROJECT ALTERNATE #7: REFERENCED ON THESE PLANS AS BID ALTERNATE #7. ALTERNATE PRICING SHALL CONSIST OF THE INSTALLATION OF VEHICLE DETECTION LOOPS ON THE INTERIOR SIDE OF THE EAST OVERHEAD DOORS TO AUTOMATICALLY OPERATE THE DOORS WHEN A VEHICLE IS EXITING. REFER TO E-300 FOR ADDITIONAL DESCRIPTIONS AND NOTATION. 2.1. 2.2. <u>BASE BID</u> SHALL BE MANUAL CONTROLS ON THE REFERENCED OVERHEAD DOORS AS DEPICTED ON PLANS.



| Delta | Description | Date Issued |
|-------|-------------|-------------|
| 1     | ADDENDUM #1 | 2012-4-6    |
|       |             |             |
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|      | PANEL _ "MDP" (EXISTIN | IG)     |        | -      | V      | OLTAGE  | 277    | . /    | 480    | V              | 3      | ø       | 4           | _ <b>w</b> |     |
|------|------------------------|---------|--------|--------|--------|---------|--------|--------|--------|----------------|--------|---------|-------------|------------|-----|
|      | FLUSH                  | MAIN    | 1200/3 | GF     |        | MLO     | X      | -      |        |                |        |         |             |            |     |
|      |                        | BUS     | 1200A  | -      | FEE    | D THRU  |        |        | -      | <b>A.I.C</b> . | 42,000 |         |             | -          |     |
| IYPE | DESCRIPTION            | BKR     | CIR    |        | LOAD ( | VOLT AN | (PS) / | PHASE  |        | CIR            | BKR    |         | DESCRIPTI   | ON         | Т   |
|      |                        |         |        | A      |        | В       |        | c      |        |                |        |         |             |            |     |
| RMKG | PANEL "SDPOPS"         | 300 /   | 1      | 74394  | 0      |         |        | -      |        | 2              |        | UNUSAB  | BLE SPACE   |            |     |
| RMKG | -                      |         | 3      |        |        | 60251   | 0      |        |        | 4              |        | UNUSAB  | BLE SPACE   |            |     |
| RMK  | -                      | / 3     | 5      |        |        | ,       |        | 58761  | 0      | 6              |        | UNUSAB  | BLE SPACE   |            |     |
| RMKG | PANEL "SDPFR"          | 600 /   | 7      | 138780 | 0      |         |        | ,      |        | 8              |        | UNUSAB  | BLE SPACE   |            |     |
| RMKG | -                      |         | 9      |        |        | 141136  | 0      |        |        | 10             |        | UNUSAB  | BLE SPACE   |            |     |
| RMG  | -                      | / 3     | 11     |        |        | ,       |        | 134493 | 0      | 12             |        | UNUSAB  | BLE SPACE   |            |     |
| М    | "RTU 1-1"              | 175 /   | 13     | 24664  | 24664  |         |        | •      |        | 14             | 175 /  | "RTU 1- | -2"         |            |     |
| М    | -                      |         | 15     | 4      |        | 24664   | 24664  |        |        | 16             |        | -       |             |            | 1   |
| М    | -                      | / 3     | 17     |        |        |         |        | 24664  | 24664  | 18             | / 3    |         |             |            | 1   |
| L    | PANEL "EMH"            | 100 /   | 19     | 4916   | 33681  |         |        | ,      |        | 20             | 225 /  | PANEL   | "H1A"       |            | RM  |
| L    | -                      |         | 21     | 4      |        | 5600    | 30195  |        |        | 22             |        | -       |             |            | LRN |
| L    | -                      | 3       | 23     |        |        |         |        | 2560   | 32576  | 24             | / 3    |         |             |            | LRN |
| G    | TVSS                   | 60 /    | 25     | 50     | 33836  |         |        | •      |        | 26             | 250/   | PANEL   | "HLVS"      |            | LR  |
| G    | -                      |         | 27     | 4      |        | 50      | 37260  |        |        | 28             |        | -       |             |            | LR  |
| G    | -                      | 3       | 29     |        |        | 1       |        | 50     | 33800  |                | / 3    |         |             |            | LR  |
|      | 200A SPACE             |         | 31     | 0      | 0      | ļ       |        | 1      |        | 32             |        | 200ASP  | ACE         |            |     |
|      | -                      |         | 33     | 4      |        | 0       | 0      |        |        | 34             |        | -       |             |            |     |
|      | -                      |         | 35     |        |        |         |        | 0      | 0      | 36             |        | -       |             |            |     |
|      |                        |         |        | 334985 |        | 323820  |        | 311568 |        | J              |        |         |             |            |     |
|      | LOAD TYPE              |         | CON    | NECTED | KVA    | тот     | 'AL    | FACT   | OR     | DE             | MAND   | KVA     | TOT         | AL         | _   |
|      |                        |         | A      | В      | С      | ALL P   | HASES  |        |        | A              | В      | С       | ALL P       | HASES      |     |
|      | LIGHTING               |         | 34.0   | 31.9   | 23.3   | 89.3    |        | 125%   |        | 42.5           | 39.9   | 29.2    | 111.6       | 5          |     |
|      | RECEPTACLE (10KVA O    | r less) | 3.3    | 3.3    | 3.3    | 10.0    |        | 100%   |        | 3.3            | 3.3    | 3.3     | 10.0        | )          |     |
|      | RECEPTACLE (OVER 10    | KVA)    | 57.7   | 46.7   | 49.2   | 153.6   |        | 50%    |        | 28.9           | 23.3   | 24.6    | 76.8        | 3          |     |
|      | HVAC/MOTOR             |         | 176.3  | 172.4  | 172.2  | 520.9   |        | 100%   |        | 176.3          | 172.4  | 172.2   | 520.9       | )          | 1   |
|      | MOTOR(LARGEST)         |         | 24.0   | 24.0   | 24.0   | 72.0    |        | 125%   |        | 30.0           | 30.0   | 30.0    | 90.0        | )          | 1   |
|      | KITCHEN EQUIPMENT      |         | 6.1    | 6.7    | 4.8    | 17.6    |        | 65%    |        | 4.0            | 4.3    | 3.1     | 11.4        |            | 1   |
|      | MISCELLANEOUS          |         | 33.5   | 38.9   | 34.7   | 107.0   |        | 100%   |        | 33.5           | 38.9   | 34.7    | 107.0       | )          | ]   |
|      | TO'                    | TAL KVA | 335.0  | 323.8  | 311.6  | 970.4   |        | тот/   | AL KVA | 318.5          | 312.1  | 297.1   | 927.7       | ,          |     |
|      | WITH GROUND BUS        |         |        |        |        |         |        | TOTAL  | . AMPS | 1149.8         | 1126.8 | 1072.7  | 1115.9      | )          |     |
|      |                        | HTING   | R =    | RECEPT | ACLE   | M = 1   | HVAC / | MOTOR  |        | = KITCH        |        |         | SCELLANEOUS | ;          | 1   |

| ſ |      |                     |         |          |        |       |           |       |         |       |          |        |                |           |       |      |
|---|------|---------------------|---------|----------|--------|-------|-----------|-------|---------|-------|----------|--------|----------------|-----------|-------|------|
|   |      | PANEL "HLVS" (NEW)  |         |          | -      | V     | OLTAGE    | 277   | . / _   | 480   | V        | 3      | ø _            | 4         | _w    |      |
|   |      | FLUSH               | MAIN    | 250/3    | _      |       | MLO       |       |         |       |          |        |                |           |       |      |
|   |      | SURFACE X           | BUS     | 250A     | _      | FEE   | THRU_     |       |         |       | A.I.C.   | 14,000 | A              |           |       |      |
|   |      |                     |         |          |        |       |           |       |         |       |          |        |                |           |       |      |
| ſ | TYPE | DESCRIPTION         | BKR     | CIR      |        | LOAD  | (VOLT A   | MPS)  | / PHASE | Ξ     | CIR      | BKR    |                | DESCRIP   | TION  | TYPE |
|   |      |                     |         |          | A      |       | В         |       | С       |       |          |        |                |           |       |      |
| ľ | L    | WALL LTG            | 20      | 1        | 776    | 0     |           |       |         |       | 2        | 20     | SPARE          |           |       |      |
|   | L    | CLG LTG             | 20      | 3        |        |       | 1536      | 0     |         |       | 4        | 20     | SPARE          |           |       |      |
|   | L    | CLG LTG             | 20      | 5        |        |       |           |       | 1536    | 0     | 6        |        | SPACE          |           |       |      |
|   | M    | MAU-2-1             | 15      | 7        | 1330   | 0     |           |       |         |       | 8        |        | SPACE          |           |       |      |
|   | M    | -                   |         | 9        |        |       | 1330      | 0     |         |       | 10       |        | SPACE          |           |       |      |
|   | M    | -                   | 3       |          |        |       | 1         |       | 1330    | 0     | 12       |        | SPACE          |           |       |      |
|   | M    | CF-1-1              | 15      | 13       | 942    | 0     | ļ         |       | 1       |       | 14       |        | SPACE          |           |       |      |
| ┟ | M    | -                   |         | 15       | -      |       | 942       | 0     |         |       | 16       |        | SPACE          |           |       |      |
| ┟ | M    | -                   | 3       |          |        |       | 1         |       | 942     | 0     | 18       |        | SPACE          |           |       |      |
| ŀ |      | SPACE               |         | 19       | 0      | 0     |           |       | 1       |       | 20       |        | SPACE          |           |       |      |
| ┟ |      | SPACE               |         | 21       | -      |       | 0         | 0     |         | •     | 22       |        | SPACE          |           |       |      |
| ┢ |      | SPACE               |         | 23       |        | •     | 1         |       | 0       | 0     | 24       |        | SPACE          |           |       |      |
| ŀ |      | SPACE<br>SPACE      |         | 25       | 0      | 0     | 0         | •     | 1       |       | 26<br>28 |        | SPACE<br>SPACE |           |       |      |
| ŀ |      | SPACE               |         | 27<br>29 | -      |       |           | 0     | 0       | 0     | 30       |        | SPACE          |           |       |      |
| ŀ |      | SPACE               |         | 31       | 0      | 0     | 1         |       |         | 0     | 32       |        | SPACE          |           |       |      |
| ŀ |      | SPACE               |         | 33       | V      |       | 0         | 0     | ]       |       | 34       |        | SPACE          |           |       |      |
| ŀ |      | SPACE               |         | 35       |        |       |           |       | 0       | 0     | 36       |        | SPACE          |           |       |      |
| ŧ | RMG  | SUBFEED             | 225 /   | 37       | 30688  | 0     | ]         |       |         | •     | 38       |        | SPACE          |           |       |      |
| * | RMG  | -                   |         | 39       |        |       | 33452     | 0     | ]       |       | 40       |        | SPACE          |           |       |      |
| * | RMG  | 150 KVA TRANSFORMER | 3       | 41       |        |       | · · · · · |       | 29992   | 0     | 42       |        | SPACE          |           |       |      |
| ſ |      | 2                   |         |          | 33736  |       | 37260     |       | 33800   |       |          |        |                |           |       |      |
|   |      | LOAD TYPE           |         | CON      | NECTE  | ) KVA | TOT       | TAL   | FACT    | OR    | DE       | MAND   | KVA            | TOT       | TAL   |      |
|   |      |                     |         | A        | В      | С     | ALL F     | HASES |         |       | A        | в      | С              | ALL F     | HASES |      |
|   |      | LIGHTING            |         | 0.8      | 1.5    | 1.5   | 3.8       |       | 125%    |       | 1.0      | 1.9    | 1.9            | 4.        | 8     |      |
|   |      | RECEPTACLE (10KVA O | r less) | 0.5      | 1.1    | 1.6   | 3.2       |       | 100%    |       | 0.5      | 1.1    | 1.6            | 3.        | 2     |      |
|   |      | RECEPTACLE (OVER 10 | KVA)    | 0.0      | 0.0    | 0.0   | 0.0       |       | 50%     |       | 0.0      | 0.0    | 0.0            | 0.        | 0     |      |
|   |      | HVAC/MOTOR          |         | 10.6     | 9.7    | 9.7   | 30.1      |       | 100%    |       | 10.6     | 9.7    | 9.7            | 30.       | .1    |      |
|   |      | MOTOR(LARGEST)      |         | 1.3      | 1.3    | 1.3   | 3.9       |       | 125%    |       | 1.6      | 1.6    | 1.6            | 4.        | 9     |      |
|   |      | KITCHEN EQUIPMENT   |         | 0.0      | 0.0    | 0.0   | 0.0       |       | 100%    |       | 0.0      | 0.0    | 0.0            | 0.        | 0     |      |
|   |      | MISCELLANEOUS       |         | 20.5     | 23.6   | 19.6  | 63.7      |       | 100%    |       | 20.5     | 23.6   | 19.6           | 63.       | 7     |      |
|   |      | TO                  | ral kva | 33.7     | 37.3   | 33.8  | 104.8     |       | TOTA    | L KVA | 34.3     | 38.0   | 34.5           | 106.      | 7     |      |
|   |      | WITH GROUND BUS     |         |          |        |       |           |       | TOTAL   | AMPS  | 123.7    | 137.1  | 124.6          | 128.      | 4     |      |
|   |      | legend L = Lig      | HTING   | R =      | RECEPT | ACLE  | M = H     | VAC / | Motor   | К     | = Kitch  | IEN    | G = MI         | SCELLANEO | US    |      |

\* INSTALL IN SUB-FEED SPACE.

| SHOWN  | FOR LOAD JUSITIFCATION PL | JRPOSES. | PART | OF BID  | LATERN | ATE <b>#</b> 2. |        |        |      |         |        |      |               |      |
|--------|---------------------------|----------|------|---------|--------|-----------------|--------|--------|------|---------|--------|------|---------------|------|
|        | PLUG-IN BUS (             | DUCT     |      | -       | VC     | LTAGE           | 120    | 1      | 208  | V       | 3      | ø    | ¥W            |      |
|        |                           | BUS      | 400A | _       |        |                 |        |        |      | A.I.C.  | 10,000 | A    |               |      |
|        |                           |          |      |         |        |                 |        |        |      |         |        |      |               |      |
| TYPE   | DESCRIPTION               | BKR      |      |         | LOAD ( | (VOLT A         | MPS)   | / PHAS | E    |         | BKR    |      | DESCRIPTION   | TYPE |
|        |                           |          |      | A       |        | В               |        | с      |      |         |        |      |               |      |
| G      | DROP CORD                 | 50       |      | 3500    | 3500   |                 |        |        |      |         | 50 /   | DROP | CORD          | G    |
| G      | -                         | 2        |      |         |        | 3500            | 3500   |        |      |         | 2      | -    |               | G    |
| G      | DROP CORD                 | 50       |      |         |        | ,               |        | 3500   | 2300 |         | 30 /   | DROP | CORD          | G    |
| G      | -                         | 2        |      | 3500    | 2300   |                 |        | 1      |      |         | 2      | -    |               | G    |
| G      | DROP CORD                 | 30       |      |         |        | 2300            | 3500   |        |      |         | 50     |      | CORD          | G    |
| G      | -                         | 2        |      |         | -      | 1               |        | 2300   | 3500 |         | / 2    | -    |               | G    |
| G      | IN-FLOOR VAULT            | 100      |      | 7500    | 0      | 7500            |        | 1      |      |         |        |      |               |      |
| G<br>G |                           | 2        |      |         |        | 7500            | 0      | 1000   | 1000 |         | 20     |      |               |      |
| 6      | DROP CORD RECP            | 20       |      | 0       | 0      | 1               |        | 1000   | 1000 |         | 20     | UKUP | CORD RECP     | G    |
| G      | DROP CORD RECP            | 20       |      | U       | 0      | 1000            | 0      | 1      |      |         |        |      |               |      |
| G      | DROP CORD RECP            | 20       |      |         |        | 1000            | •      | 1000   | 1000 |         | 20     | DROP | CORD RECP     | G    |
|        |                           |          |      | 0       | 0      | ]               |        |        |      |         |        |      |               |      |
| G      | DROP CORD RECP            | 20       |      |         |        | 1000            | 0      |        |      |         |        |      |               |      |
| G      | DROP CORD RECP            | 20       |      |         |        |                 |        | 1000   | 1000 |         | 20     | DROP | CORD RECP     | G    |
|        |                           |          |      | 0       | 0      |                 |        |        |      |         |        |      |               |      |
| G      | DROP CORD RECP            | 20       |      |         |        | 1000            | 0      |        |      |         |        |      |               |      |
| G      | DROP CORD RECP            | 20       |      |         |        | 1               |        | 1000   | 0    |         |        |      |               |      |
|        |                           |          |      | 0       | 0      |                 |        | 1      |      |         |        |      |               |      |
|        |                           |          |      |         |        | 0               | 0      |        |      |         |        |      |               |      |
| G      | DROP CORD RECP            | 20       |      | 00700   |        | 07700           |        | 1000   | 0    |         |        |      |               |      |
|        |                           |          |      | 20300   |        | 23300           |        | 19600  |      |         |        |      |               |      |
|        | LOAD TYPE                 |          |      | INECTED |        |                 | TAL    | FAC    | IOR  | DE      | EMAND  |      | TOTAL         | л Г  |
|        |                           |          | A    | В       | С      | ALL F           | PHASES |        |      | A       | B      | C    | ALL PHASES    |      |
|        | LIGHTING                  |          | 0.0  | 0.0     | 0.0    | 0.0             |        | 125%   |      | 0.0     | 0.0    | 0.0  | 0.0           |      |
|        | RECEPTACLE (10KVA OR      | ≀ LESS)  | 0.0  | 0.0     | 0.0    | 0.0             |        | 100%   |      | 0.0     | 0.0    | 0.0  | 0.0           |      |
|        | RECEPTACLE (OVER 10K      | (VA)     | 0.0  | 0.0     | 0.0    | 0.0             |        | 50%    |      | 0.0     | 0.0    | 0.0  | 0.0           |      |
|        | HVAC/MOTOR                |          | 0.0  | 0.0     | 0.0    | 0.0             |        | 100%   |      | 0.0     | 0.0    | 0.0  | 0.0           |      |
|        | MOTOR(LARGEST)            |          | 0.0  | 0.0     | 0.0    | 0.0             |        | 125%   |      | 0.0     | 0.0    | 0.0  | 0.0           |      |
|        | KITCHEN EQUIPMENT         |          | 0.0  | 0.0     | 0.0    | 0.0             |        | 100%   |      | 0.0     | 0.0    | 0.0  | 0.0           | 1    |
|        | MISCELLANEOUS             |          | 20.3 | 23.3    | 19.6   | 63.2            |        | 100%   |      | 20.3    | 23.3   | 19.6 | 63.2          | 1    |
|        |                           | AL KVA   |      |         | 19.6   | 63.2            |        | TOTA   |      |         | 23.3   |      |               | 1    |
|        |                           | ∩⊑ T\¥A\ | 20.5 | 20.0    | 19.0   | 00.2            |        |        |      |         |        |      |               |      |
|        | WITH GROUND BUS           | -        |      | 05055   |        |                 |        |        |      |         | 194.2  |      |               |      |
|        | LEGEND L = LIGHTING R =   |          |      | RECEPT  | ACLE   | M = H           | ivac / | MOTOR  | K    | = KITCH | IEN    | G =  | MISCELLANEOUS |      |
|        |                           |          |      |         |        |                 |        |        |      |         |        |      |               |      |

| BASE-BID | PANEL. | IF BID ALTERN | ATE #4 | IS ACCEPTE | ED, D |
|----------|--------|---------------|--------|------------|-------|
|          | PANEL  | "LLVS2" (NEW  | )      |            |       |

|      | PANEL "LLVS2" (NEW)  |        |          |           |          |        |          | 1       | 208   | v        | 3       | ø     | 4 W           |      |
|------|----------------------|--------|----------|-----------|----------|--------|----------|---------|-------|----------|---------|-------|---------------|------|
|      | FLUSH                |        | 400/3    |           |          |        |          |         |       |          |         | •     |               |      |
|      |                      |        |          |           |          | ) THRU |          |         |       | A.I.C.   | 10,000/ | 4     |               |      |
|      |                      |        |          |           |          |        |          |         |       |          |         | •     |               |      |
| TYPE | DESCRIPTION          | BKR    | CIR      |           |          |        |          | / PHASI | -     | CIR      | BKR     |       | DESCRIPTION   | TYPE |
| 1116 | DESCRIPTION          | DIVIN  | CIR      |           |          | B      |          |         | -     | UIN      |         |       | DESCRIPTION   | 1166 |
| G    | DROP CORD            | 50 /   | 1        | A<br>3500 | 3500     | D      |          | C       |       | 2        | 50 /    | DROP  | 0000          | G    |
| G    |                      | 2      | 3        | 3300      | 3300     | 3500   | 3500     |         |       | 4        | 2       |       |               | G    |
| G    | DROP CORD            | 50     | 5        |           |          |        |          | 3500    | 2300  | 6        | 30 /    | DROP  | CORD          | G    |
| G    | -                    | 2      | 7        | 3500      | 2300     | ]      | I        |         |       | 8        | 2       | _     |               | G    |
| G    | DROP CORD            | 30 /   | 9        |           |          | 2300   | 3500     |         |       | 10       | 50 /    | DROP  | CORD          | G    |
| G    | -                    | 2      | 11       |           |          |        |          | 2300    | 3500  | 12       | 2       | -     |               | G    |
| G    | IN-FLOOR VAULT       | 100    | 13       | 7500      | 0        |        |          |         |       | 14       |         | SPACE | •             |      |
| G    | -                    | 2      | 15       |           |          | 7500   | 0        |         |       | 16       |         | SPACE |               |      |
| G    | DROP CORD RECP       | 20     | 17       |           |          | 1      |          | 1000    | 1000  | 18       | 20      |       | CORD RECP     | G    |
|      | SPACE                |        | 19       | 0         | 0        |        |          | 1       |       | 20       |         | SPACE |               |      |
| G    | DROP CORD RECP       | 20     | 21       |           |          | 1000   | 0        |         |       | 22       |         | SPACE |               |      |
| G    | DROP CORD RECP       | 20     | 23       | •         |          | 1      |          | 1000    | 1000  | 24       | 20      |       | CORD RECP     | G    |
|      | SPACE                |        | 25       | 0         | 0        | 4000   | •        | 1       |       | 26       |         | SPACE |               |      |
| G    | DROP CORD RECP       | 20     | 27       |           |          | 1000   | 0        | 1000    | 1000  | 28       |         | SPACE |               | G    |
| G    | DROP CORD RECP       | 20     | 29<br>31 | 0         | 0        | 1      |          |         | 1000  | 30<br>32 | 20      | SPACE | CORD RECP     | G    |
| G    | DROP CORD RECP       | 20     | 33       | V         | <u> </u> | 1000   | 0        |         |       | <u> </u> |         | SPACE |               |      |
|      | DROP CORD RECP       | 20     | 35       |           |          | 1000   |          | 1000    | 0     | 36       |         | SPACE |               |      |
| -    | SPACE                |        | 37       | 0         | 0        | ]      |          |         | •     | 38       |         | SPACE |               |      |
|      | SPACE                |        | 39       |           |          | 0      | 0        | 1       |       | 40       |         | SPACE |               |      |
| G    | DROP CORD RECP       | 20     | 41       |           |          |        |          | 1000    | 0     | 42       |         | SPACE |               |      |
|      |                      |        |          | 20300     |          | 23300  |          | 19600   |       |          |         |       |               |      |
|      | LOAD TYPE            |        | CON      | INECTED   | ) KVA    | TO     | TAL      | FACT    | OR    | DE       | MAND    | KVA   | TOTAL         |      |
|      |                      |        | A        | в         | С        | ALL F  | PHASES   |         |       | A        | В       | С     | ALL PHASES    |      |
|      | LIGHTING             |        | 0.0      | 0.0       | 0.0      | 0.0    |          | 125%    |       | 0.0      | 0.0     | 0.0   | 0.0           |      |
|      | RECEPTACLE (10KVA OR | LESS)  | 0.0      | 0.0       | 0.0      | 0.0    |          | 100%    |       | 0.0      | 0.0     | 0.0   | 0.0           |      |
|      | RECEPTACLE (OVER 10K | VA)    | 0.0      | 0.0       | 0.0      | 0.0    |          | 50%     |       | 0.0      | 0.0     | 0.0   | 0.0           |      |
|      | HVAC/MOTOR           |        | 0.0      | 0.0       | 0.0      | 0.0    |          | 100%    |       | 0.0      | 0.0     | 0.0   | 0.0           |      |
|      | MOTOR(LARGEST)       |        | 0.0      | 0.0       | 0.0      | 0.0    |          | 125%    |       | 0.0      | 0.0     | 0.0   | 0.0           |      |
|      | KITCHEN EQUIPMENT    |        | 0.0      | 0.0       | 0.0      | 0.0    |          | 100%    |       | 0.0      | 0.0     | 0.0   | 0.0           |      |
|      | MISCELLANEOUS        |        | 20.3     | 23.3      | 19.6     | 63.2   |          | 100%    |       | 20.3     | 23.3    | 19.6  | 63.2          |      |
|      | TOT/                 | AL KVA | 20.3     | 23.3      | 19.6     | 63.2   |          | TOTA    | L KVA | 20.3     | 23.3    | 19.6  | 63.2          |      |
|      | WITH GROUND BUS      |        |          |           |          |        |          |         |       | 169.2    | 194.2   | 163.3 |               |      |
|      | LEGEND L = LIGH      | ITING  | R =      | RECEPT    | ACLE     | M = ⊦  | ivac / I |         |       | = KITCH  |         |       | MISCELLANEOUS |      |
|      |                      |        |          |           |          |        | •        |         |       |          |         |       |               |      |

|      |                      |        |                  | •      |      |         | 120     | . /    | 200   | •       |        | -        | <b>"</b>      |    |
|------|----------------------|--------|------------------|--------|------|---------|---------|--------|-------|---------|--------|----------|---------------|----|
|      | FLUSH                | MAIN   | 100/3            |        |      | MLO     |         |        |       |         |        |          |               |    |
|      |                      | BUS    | 100A             |        | FEE  | d thru  |         |        |       | A.I.C.  | 10,000 | A        |               |    |
|      |                      |        |                  |        |      |         |         |        |       |         |        |          |               |    |
| TYPE | DESCRIPTION          | BKR    | CIR              |        | LOAD | (VOLT A | AMPS) , | / PHAS | E     | CIR     | BKR    |          | DESCRIPTION   | TY |
|      |                      |        |                  | A      |      | В       |         | c      |       |         |        |          |               |    |
| G    | CARD READER          | 20     | 1                | 200    | 540  |         |         |        |       | 2       | 20     | RECEP    | rs            | F  |
| G    | FIRE ALARM           | 20     | 3                |        |      | 300     | 1080    |        |       | 4       | 20     | RECEP    | rs            | F  |
| M    | EF-1-1               | 20     | 5                |        | -    | -       |         | 1176   | 540   | 6       | 20     | RECEP    | rs            | F  |
| M    | EF-1-2               | 20     | 7                | 1176   | 1176 |         |         |        |       | 8       | 20     | OVERH    | EAD DOOR      | N  |
| M    | CF-1-1               | 20     | 9                |        |      | 300     | 1176    |        |       | 10      | 20     | OVERH    | EAD DOOR      | N  |
| M    | CF-1-2               | 20     | 11               |        | 1    | -       |         | 300    | 1176  | 12      | 20     | OVERH    | EAD DOOR      | N  |
| M    | UH-1-1               | 20     | 13               | 864    | 1176 |         |         |        |       | 14      | 20     | OVERH    | EAD DOOR      | N  |
| M    | UH-1-2               | 20     | 15               |        |      | 864     | 1176    |        |       | 16      | 20     |          | EAD DOOR      | N  |
| M    | UH-1-3               | 20     | 17               |        | 1    | -       |         | 864    | 1176  | 18      | 20     |          | EAD DOOR      | N  |
| M    | UH-1-4               | 20     | 19               | 864    | 1176 |         |         | 1      |       | 20      | 20     |          | EAD DOOR      | N  |
| M    | UH-1-5               | 20     | 21               |        |      | 864     | 1176    |        |       | 22      | 20     |          | EAD DOOR      | Ň  |
| M    | UH-1-6               | 20     | 23               |        |      | ٦       |         | 864    | 1176  | 24      | 20     |          | EAD DOOR      | Ň  |
| M    | UH-1-7               | 20     | 25               | 864    | 1176 |         | 1       | 1      |       | 26      | 20     |          | EAD DOOR      | Ň  |
| M    | UH-1-8               | 20     | 27               |        |      | 864     | 1176    |        |       | 28      | 20     |          | EAD DOOR      | Ň  |
| M    | UH-1-9               | 20     | 29               |        |      | 1       |         | 864    | 1176  | 30      | 20     |          | EAD DOOR      | Ň  |
|      | SPACE                |        | 31               | 0      | 1176 |         | 4470    |        |       | 32      | 20     |          | EAD DOOR      | Ň  |
|      | SPACE                |        | 33               |        |      | 0       | 1176    |        | 4000  | 34      | 20     |          | EAD DOOR      |    |
|      | SPACE                |        | 35               |        |      | Г       |         | 0      | 1080  | 36      | 20     | RECEP    |               | 1  |
|      | SPACE                |        | 37               | 0      | 0    |         |         | 1      |       | 38      | 20     | SPARE    |               |    |
|      | SPACE                |        | 39               |        |      | 0       | 0       | 0      | •     | 40      | 20     | SPARE    |               |    |
|      | SPACE                |        | 41               | 10388  |      | 10152   |         | 10392  | 0     | 42      | 20     | SPARE    |               |    |
|      |                      |        |                  |        |      | 10152   |         |        |       |         |        |          |               |    |
|      | LOAD TYPE            |        |                  | INECTE |      |         | TAL     | FAC    | IOR   |         | Emand  |          | TOTAL         | 1  |
|      |                      |        | A                | В      | C    | ALL     | PHASES  |        |       | A       | В      | <u> </u> | ALL PHASES    |    |
|      | LIGHTING             |        | 0.0              | 0.0    | 0.0  | 0.0     |         | 125%   |       | 0.0     | 0.0    | 0.0      | 0.0           |    |
|      | RECEPTACLE (10KVA OR | LESS)  | 0.5              | 1.1    | 1.6  | 3.2     |         | 100%   |       | 0.5     | 1.1    | 1.6      | 3.2           |    |
|      | RECEPTACLE (OVER 10K | VA)    | 0.0              | 0.0    | 0.0  | 0.0     |         | 50%    |       | 0.0     | 0.0    | 0.0      | 0.0           |    |
|      | HVAC/MOTOR           |        | 8.5              | 8.8    | 8.8  | 26.1    |         | 100%   |       | 8.5     | 8.8    | 8.8      | 26.1          |    |
|      | MOTOR(LARGEST)       |        | 1.1              | 0.0    | 0.0  | 1.1     |         | 125%   |       | 1.4     | 0.0    | 0.0      | 1.4           |    |
|      | KITCHEN EQUIPMENT    |        | 0.0              | 0.0    | 0.0  | 0.0     |         | 100%   |       | 0.0     | 0.0    | 0.0      | 0.0           |    |
|      | MISCELLANEOUS        |        | 0.2              | 0.3    | 0.0  | 0.5     |         | 100%   |       | 0.2     | 0.3    | 0.0      | 0.5           |    |
|      | τοτ/                 | AL KVA | 10. <del>4</del> | 10.2   | 10.4 | 30.9    |         | тоти   | L KVA | 10.7    | 10.2   | 10.4     | 31.2          |    |
|      | WITH GROUND BUS      |        |                  |        |      |         |         | TOTAL  | AMPS  | 88.9    | 84.6   | 86.6     | 86.6          |    |
|      | LEGEND L = LIGH      | ITING  | R =              | RECEPT | ACLE | M = 1   | hvac /  | MOTOR  | K     | = Kitch | IEN    | G = N    | IISCELLANEOUS |    |
|      |                      |        |                  |        |      |         |         |        |       |         |        |          |               |    |

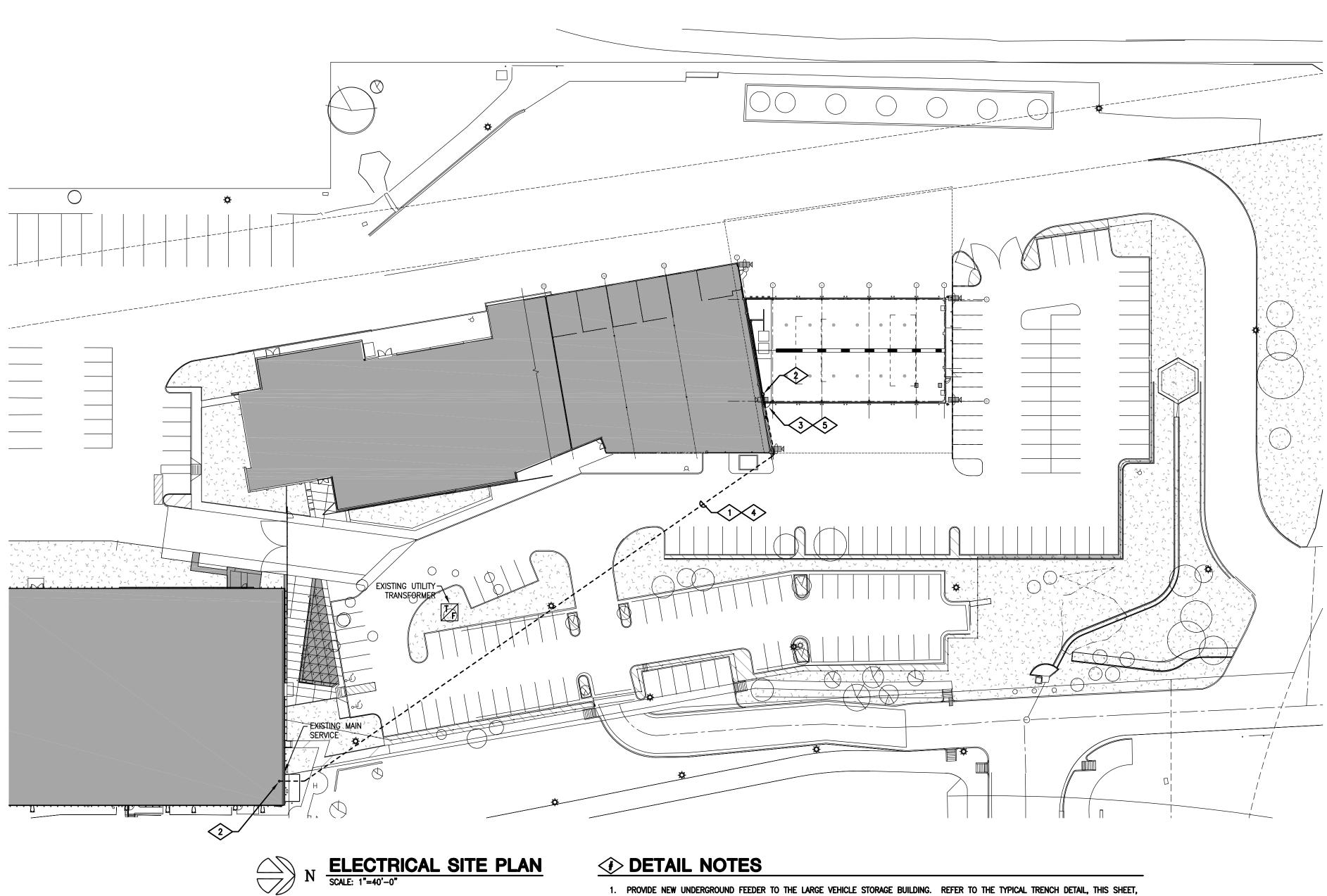
PANEL "LLVS" (NEW)

VOLTAGE <u>120</u> / <u>208</u> V <u>3</u> Ø <u>4</u> W

|     | TRANSFORMER         | LOAD    |      | -      | VC    | OLTAGE 120    | /      | 208   | ۷     | 3     | ø     | <u>4</u> ₩   |    |
|-----|---------------------|---------|------|--------|-------|---------------|--------|-------|-------|-------|-------|--------------|----|
| YPE | DESCRIPTION         | BKR     | CIR  |        | LOAD  | (VOLT AMPS) , | / PHAS | E     | CIR   | BKR   |       | DESCRIPTION  | TY |
|     |                     |         |      | A      |       | В             | с      |       |       |       |       |              |    |
| G   | 400A BUSWAY/LLVS2   | 400     |      | 20300  | 10388 |               |        |       |       | 100 / | PANEL | "LLVS"       | RI |
| G   | -                   |         |      |        |       | 23300 10152   |        |       |       |       | -     |              | RI |
| G   | -                   | 3       |      |        |       |               | 19600  | 10392 |       | / 3   | -     |              | R  |
|     |                     |         |      | 30688  |       | 33452         | 29992  |       |       |       |       |              |    |
|     | LOAD TYPE           |         | CON  | NECTE  | ) KVA | TOTAL         | FAC    | TOR   | DE    | EMAND | KVA   | TOTAL        | -  |
|     |                     |         | A    | В      | С     | ALL PHASES    |        |       | A     | В     | С     | ALL PHASES   |    |
|     | LIGHTING            |         | 0.0  | 0.0    | 0.0   | 0.0           | 125%   |       | 0.0   | 0.0   | 0.0   | 0.0          |    |
|     | RECEPTACLE (10KVA O | r less) | 0.5  | 1.1    | 1.6   | 3.2           | 100%   |       | 0.5   | 1.1   | 1.6   | 3.2          |    |
|     | RECEPTACLE (OVER 10 | KVA)    | 0.0  | 0.0    | 0.0   | 0.0           | 50%    |       | 0.0   | 0.0   | 0.0   | 0.0          |    |
|     | HVAC/MOTOR          |         | 9.6  | 8.8    | 8.8   | 27.2          | 100%   |       | 9.6   | 8.8   | 8.8   | 27.2         | 1  |
|     | MOTOR(LARGEST)      |         | 0.0  | 0.0    | 0.0   | 0.0           | 125%   |       | 0.0   | 0.0   | 0.0   | 0.0          | 1  |
|     | KITCHEN EQUIPMENT   |         | 0.0  | 0.0    | 0.0   | 0.0           | 100%   |       | 0.0   | 0.0   | 0.0   | 0.0          | 1  |
|     | MISCELLANEOUS       |         | 20.5 | 23.6   | 19.6  | 63.7          | 100%   |       | 20.5  | 23.6  | 19.6  | 63.7         | 1  |
|     | ТОТ                 | TAL KVA | 30.7 | 33.5   | 30.0  | 94.1          | TOTA   | L KVA | 30.7  | 33.5  | 30.0  | 94.1         | 1  |
|     | WITH GROUND BUS     |         |      |        |       | •             | TOTAL  | AMPS  | 255.7 | 278.8 | 249.9 | 261.3        | 1  |
|     |                     | HTING   | R =  | RECEPT | ACLE  | M = HVAC /    |        |       |       |       |       | ISCELLANEOUS |    |

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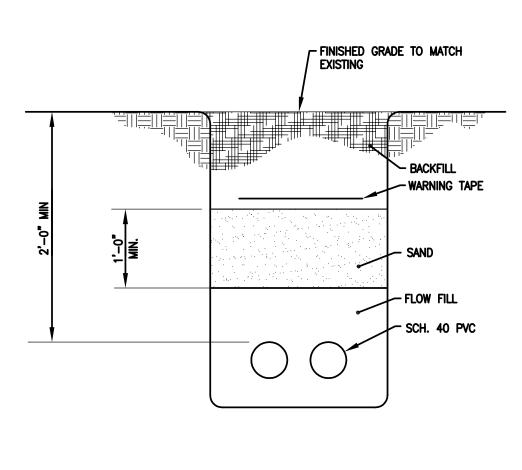
## DELETE THIS PANEL FROM SCOPE.



GENERAL NOTES:

A. NEW AND RELOCATED ITEMS SHOWN AS BOLD \_\_\_\_\_\_ EXISTING ITEMS SHOWN AS LIGHT \_\_\_\_\_

- 1. PROVIDE NEW UNDERGROUND FEEDER TO THE LARGE VEHICLE STORAGE BUILDING. REFER TO THE TYPICAL TRENCH DETAIL, THIS SHEET, FOR ADDITIONAL INFORMATION. MINIMUM BURIAL DEPTH SHALL BE 24" FROM FINISHED GRADE TO TOP OF CONDUIT, WITH WARNING TAPE INSTALLED IN TRENCH AT 8" BELOW FINISH GRADE.
- 2. TRANSITION FROM NON-METALLIC CONDUIT TO GRC AT BUILDING STUB-UP. LOCATION OF CONDUIT STUB-UP IS APPROXIMATE. 3. PROVIDE NON-FUSED DISCONNECT AT BUILDING EXTERIOR FOR LOCAL DISCONNECTING MEANS, PER ONE-LINE. EXACT LOCATION TO BE COORDINATE IN FIELD.
- 4. PROVIDE 4" SPARE SCHEDULE 40 PVC CONDUIT WITH PULL STRING IN THE SAME TRENCH AS THE ELECTRICAL FEEDERS. COORDINATE EXACT STUB-UP LOCATIONS IN FIELD. AT THE TRAFFIC OPERATIONS BUILDING, STUB INTO THE MAIN ELECTRICAL ROOM. CAP CONDUIT ENDS WITH WEATHER-PROOF CAPS AND LABEL CONDUIT AS SPARE.
- 5. PROVIDE PERMANENT LABEL ON THE NONFUSED DISCONNECT CLEARLY INDICATING THAT IT IS A SERVICE DISCONNECTING MEANS FOR THE BUILDING.

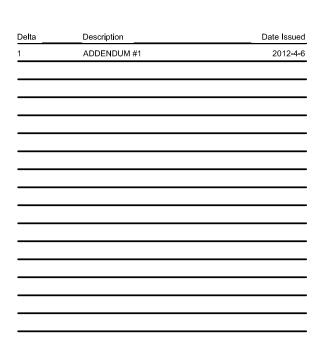


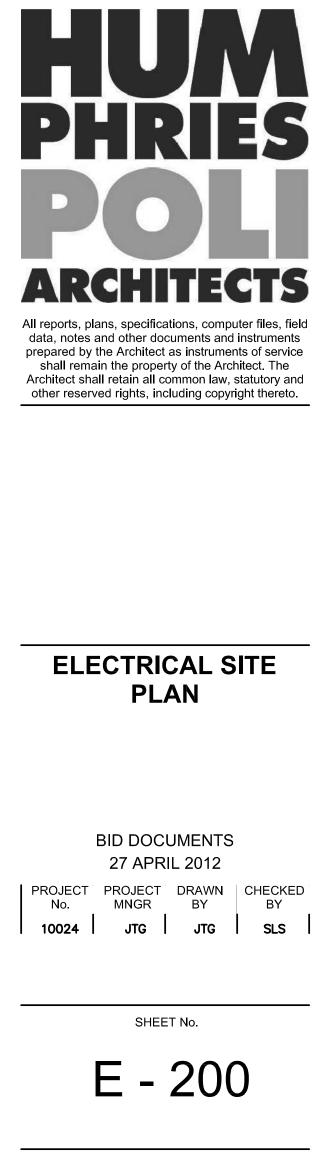
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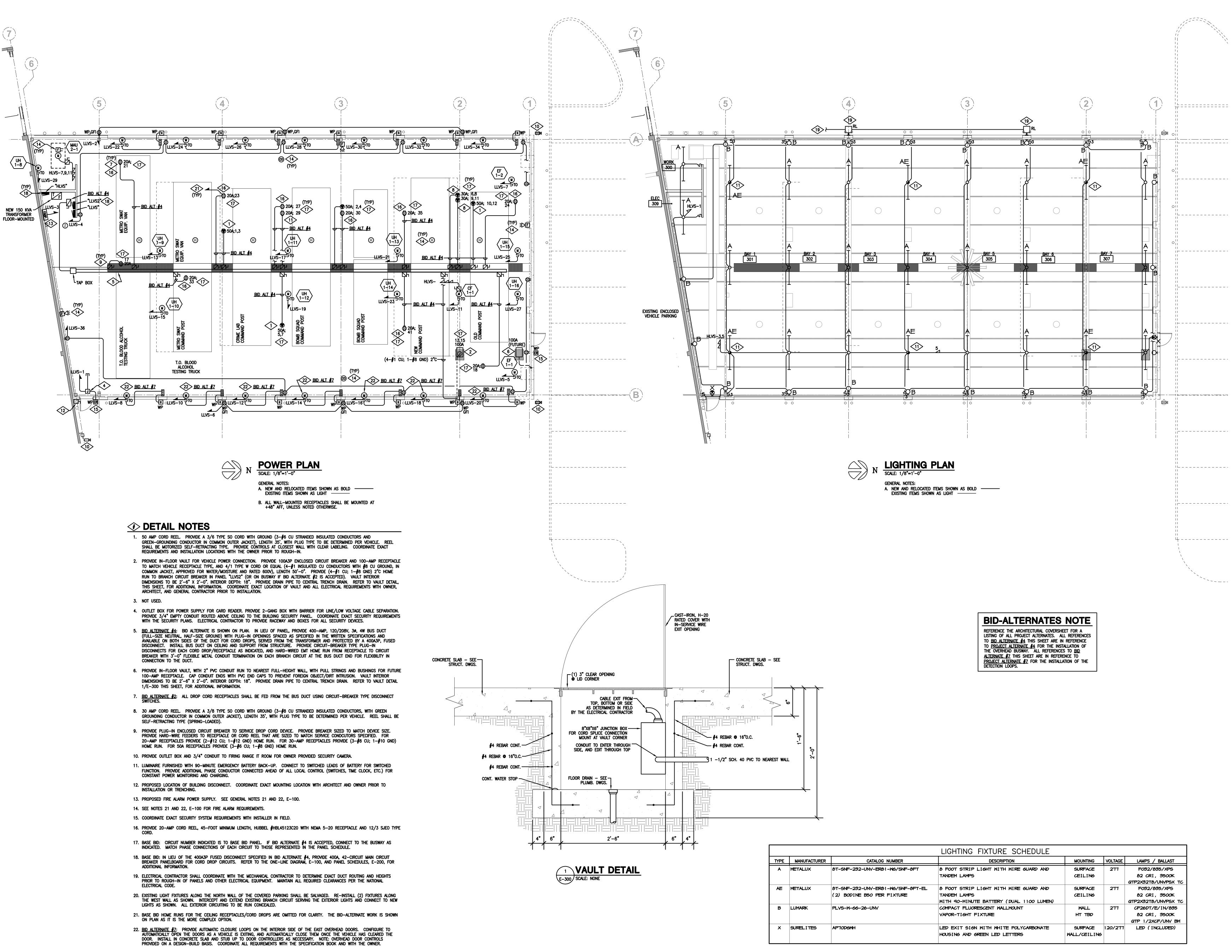
|               |                       |      |    |     | ME  |     | NICAL EQUIPMENT SC  | HEDULE  | -    | -    |                |         |
|---------------|-----------------------|------|----|-----|-----|-----|---------------------|---------|------|------|----------------|---------|
| DESIGNATION   | DESCRIPTION           | VOLT | PH | FLA | HP  | KVA | CONDUCTORS          | CONDUIT | sw   | СВ   | FUSE SIZE/TYPE | REMARKS |
|               |                       |      |    |     |     |     |                     |         |      |      |                |         |
| -2-1          | MAKEUP AIR UNIT (GAS) | 480  | 3  | -   | 3   | -   | 3-#12 CU; 1-#12 GND | 3/4*    | 30/3 | 15/3 | 15A FRS-R      | Α       |
| 1–1           | EXHAUST FAN           | 120  | 1  | -   | 1/2 | -   | 2-#12 CU; 1-#12 GND | 1/2"    | STO  | 20/1 | -              | A,B     |
| 1–2           | EXHAUST FAN           | 120  | 1  | -   | 1/2 | -   | 2-#12 CU; 1-#12 GND | 1/2"    | STO  | 20/1 | -              | A,B     |
| 1–1           | CEILING FAN           | 480  | 3  | -   | 1.5 | -   | 3-#12 CU; 1-#12 GND | 1/2"    | 30/3 | 15/3 | 10A FRS-R      | Α       |
| -1            | INFRARED HTR (GAS)    | 120  | 1  | 5   | -   | -   | 2-#12 CU; 1-#12 GND | 1/2"    | STO  | 20/1 | -              | Α       |
| -2 THRU 1-6   | INFRARED HTR (GAS     | 120  | 1  | 1   | -   | _   | 2-#12 CU; 1-#12 GND | 1/2"    | STO  | 20/1 | -              | Α       |
| 1—1 THRU 1—7  | UNIT HEATER (GAS)     | 120  | 1  | -   | -   | 0.3 | 2-#12 CU; 1-#12 GND | 1/2"    | STO  | 20/1 | -              | Α       |
| 1-8 THRU 1-16 | UNIT HEATER (GAS)     | 120  | 1  | 5.3 | 1/3 | -   | 2-#12 CU; 1-#12 GND | 1/2"    | STO  |      | -              | A       |
|               |                       |      |    |     |     |     |                     |         |      |      |                |         |

A. REFER TO THE MECHANICAL PLANS FOR ALL CONTROL REQUIREMENTS. ANY LINE-VOLTAGE CONTROL ELEMENTS TO BE INSTALLED AND WIRED BY ELECTRICAL. B. INTERLOCK UNIT WITH CARBON MONOXIDE SENSORS. REFER TO MECHANICAL DRAWINGS FOR SENSOR LOCATIONS.







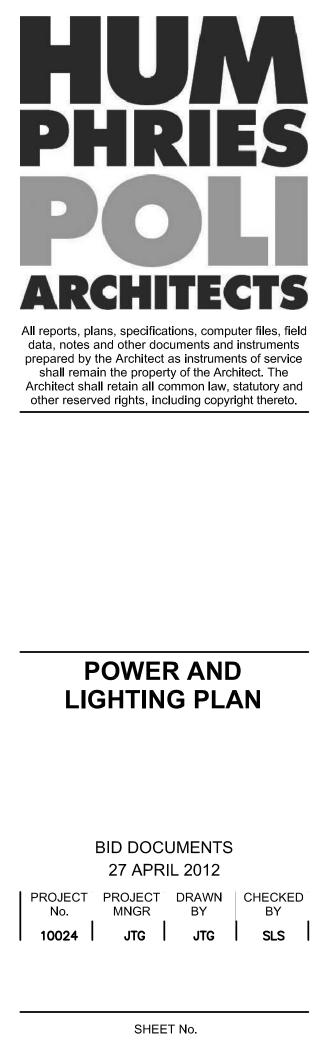


|           |                                                                 | LIGHTING FIXTURE SCHEDULE                                                                          |                         |         |                                                       |
|-----------|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-------------------------|---------|-------------------------------------------------------|
| JFACTURER | CATALOG NUMBER                                                  | DESCRIPTION                                                                                        | MOUNTING                | VOLTAGE | LAMPS / BALLAST                                       |
| .UX       | 8T-SNF-232-UNV-ER81-W6/SNF-8FT                                  | 8 FOOT STRIP LIGHT WITH WIRE GUARD AND<br>TANDEM LAMPS                                             | SURFACE<br>CEILING      | 277     | F032/835/XPS<br>82 CRI, 3500K<br>QTP2X32T8/UNVPSX TC  |
| .UX       | 8T-SNE-232-UNV-ER81-W6/SNE-8FT-EL<br>(2) BODINE B50 PER FIXTURE | 8 FOOT STRIP LIGHT WITH WIRE GUARD AND<br>TANDEM LAMPS<br>WITH 90-MINUTE BATTERY (DUAL 1100 LUMEN) | SURFACE<br>CEILING      | 277     | F032/835/XPS<br>82 CRI, 3500K<br>QTP2X32T8/UNVPSX TC  |
| ĸ         | PLVS-W-66-26-UNV                                                | COMPACT FLUORESCENT WALLMOUNT<br>VAPOR-TIGHT FIXTURE                                               | WALL<br>HT TBD          | 277     | CF26DT/E/IN/835<br>82 CRI, 3500K<br>QTP 1/2XCF/UNV BM |
| .ITES     | APTODEMH                                                        | LED EXIT SIGN WITH WHITE POLYCARBONATE<br>HOUSING AND GREEN LED LETTERS                            | SURFACE<br>WALL/CEILING | 120/277 | LED (INCLUDED)                                        |

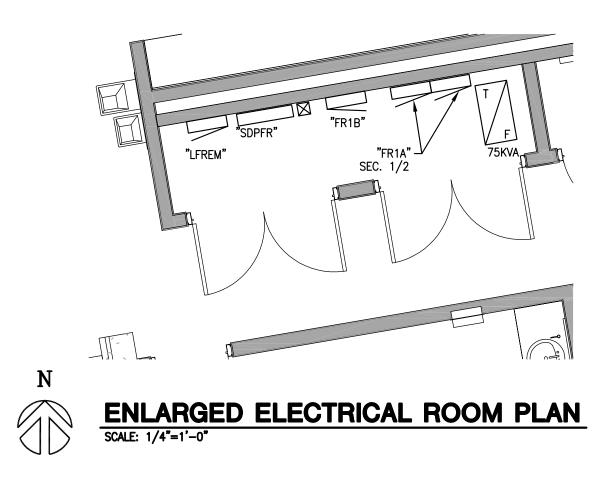


Denver Traffic **Operations Command** Vehicle Storage & Modifications 3501 Park Avenue Denver, CO 80216

| Description | Date Issued |
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| ADDENDUM #1 | 2012-4-6    |
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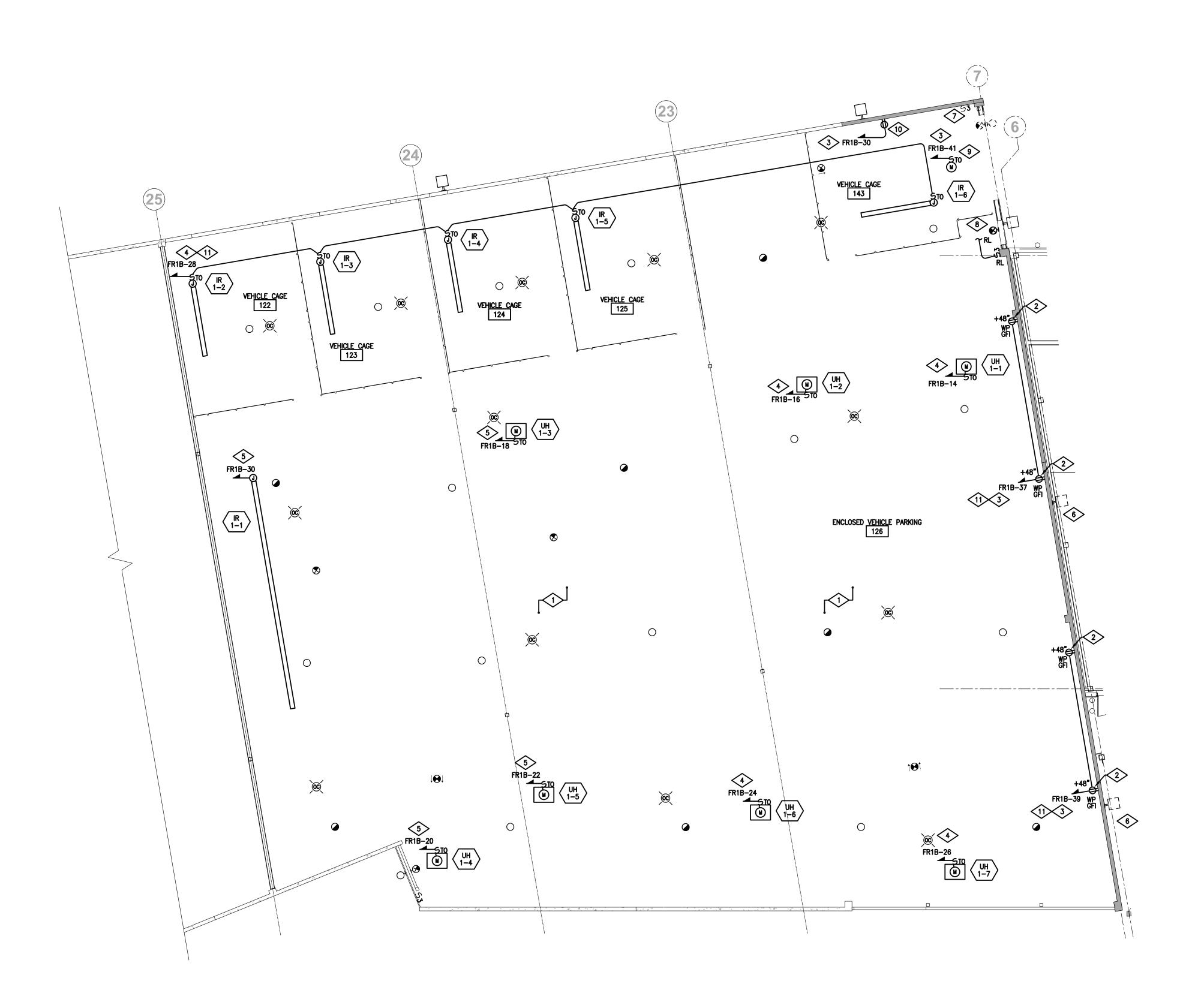
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|      | PANEL FR1B" (   |             |      | -      | V            | OLTAGE  | 120     | . /    | 208      | <u>v</u> | 3      | ø      | 4       |
|------|-----------------|-------------|------|--------|--------------|---------|---------|--------|----------|----------|--------|--------|---------|
|      | FLUSH           | MAIN        |      | -      |              | MLO     | X       |        |          |          |        |        |         |
|      |                 | BUS         | 100A | -      | FEEI         | ) thru  | -       |        | -        | A.I.C.   | 10,000 |        |         |
| TYPE | DESCRIPTION     | BKR         | CIR  |        | LOAD         | (VOLT / | AMPS) / | / PHAS | E        | CIR      | BKR    |        | DESCR   |
|      |                 |             |      | A      |              | В       |         | c      |          |          |        |        |         |
| G    | CHARGER         | 20          | 1    | 650    | 1080         |         |         |        |          | 2        | 20     | GARAGE | E RCPT  |
| G    | CHARGER         | 20          | 3    |        |              | 650     | 540     |        |          | 4        | 20     | ROOF 1 | top gfi |
| G    | CHARGER         | 20          | 5    |        |              | -       |         | 650    | 250      | 6        | 20     | AUDIO  | CAB     |
| G    | CHARGER         | 20          | 7    | 650    | 500          |         |         |        |          | 8        | 20     | MASTER | CONTRO  |
| R    | POWER POLE      | 20          | 9    | 1      |              | 900     | 2000    |        |          | 10       | 50     | OWNER  | EQUIPME |
| R    | POWER POLE      | 20          | 11   |        |              | -       |         | 540    | 2000     | 12       | 2      | -      |         |
| R    | POWER POLE      | 20          | 13   | 540    | 1176         |         |         | ,      |          | 14       | 20     | UH-1   | -1      |
| R    | POWER POLE      | 20          | 15   | 1      |              | 540     | 1176    |        |          | 16       | 20     | UH-1   | -2      |
| R    | POWER POLE      | 20          | 17   |        |              | -       |         | 900    | 1176     | 18       | 20     | UH-1   | -3      |
| R    | POWER POLE      | 20          | 19   | 540    | 1176         |         |         | 1      |          | 20       | 20     | UH-1   | -4      |
| R    | POWER POLE      | 20          | 21   | 1      |              | 540     | 1176    |        |          | 22       | 20     | UH-1   | -5      |
| R    | POWER POLE      | 20          | 23   |        |              | -       |         | 540    | 1176     | 24       | 20     | UH-1   | -6      |
| R    | HAIR DRYER      | 30          | 25   | 1700   | 1176         |         |         | 1      |          | 26       | 20     | UH-1   | -7      |
| R    | HAIR DRYER      | 30          | 27   | 4      |              | 1700    | 600     |        |          | 28       | 20     |        | 2 THRU  |
| R    | HAIR DRYER      | 30          | 29   |        |              | 1       |         | 1700   | 600      | 30       | 20     | IR-1-  |         |
| G    | TARGET REEL     | 15          | 31   | 500    | 500          |         | ,       | 1      |          | 32       | 20     |        | STN RE  |
| G    | TARGET REEL     | 15          | 33   | 4      |              | 500     | 0       |        | r        | 34       |        | SPACE  |         |
| G    | TARGET REEL     | 15          | 35   |        |              | -       |         | 500    | 0        | 36       |        | SPACE  |         |
| R    | GARAGE RECPS    | 20          | 37   | 360    | 0            |         | 1       | 1      |          | 38       |        | SPACE  |         |
| R    | GARAGE RECPS    | 20          | 39   | 4      |              | 360     | 0       |        | <u> </u> | 40       |        | SPACE  |         |
| M    | OVERHEAD DR     | 20          | 41   |        |              |         |         | 864    | 0        | 42       |        | SPACE  |         |
|      |                 |             |      | 10548  |              | 10682   |         | 10896  |          | J        |        |        |         |
|      | LOAD            | TYPE        | CON  | NECTE  | <u>d kva</u> | TC      | TAL     | FAC    | TOR      |          | EMAND  | KVA    | T       |
|      |                 |             | A    | В      | C            | ALL     | PHASES  |        |          | A        | В      | C      | ALL     |
|      | LIGHTING        |             | 0.0  | 0.0    | 0.0          | 0.0     |         | 125%   |          | 0.0      | 0.0    | 0.0    |         |
|      | RECEPTACLE (10K | VA OR LESS) | 3.3  | 3.3    | 3.3          | 10.0    |         | 100%   |          | 3.3      | 3.3    | 3.3    | 1       |
|      | RECEPTACLE (OVE | R 10KVA)    | 0.9  | 1.3    | 0.4          | 2.5     |         | 50%    |          | 0.4      | 0.6    | 0.2    |         |
|      | HVAC/MOTOR      |             | 3.5  | 2.4    | 3.2          | 9.1     |         | 100%   |          | 3.5      | 2.4    | 3.2    |         |
|      | MOTOR(LARGEST)  |             | 0.0  | 0.0    | 0.0          | 0.0     |         | 125%   |          | 0.0      | 0.0    | 0.0    |         |
|      | KITCHEN EQUIPME | ΝΤ          | 0.0  | 0.0    | 0.0          | 0.0     |         | 100%   |          | 0.0      | 0.0    | 0.0    |         |
|      | MISCELLANEOUS   |             | 2.8  | 3.8    | 4.0          | 10.6    |         | 100%   |          | 2.8      | 3.8    | 4.0    | 1       |
|      |                 | TOTAL KVA   |      | 10.7   | 10.9         | 32.1    |         |        | AL KVA   |          | 10.1   | 10.7   | 3       |
|      | WITH GROUND BUS |             |      |        |              |         |         | •      | . AMPS   |          | 83.8   | 89.3   | 8       |
|      | r i             | = LIGHTING  | _    | RECEPT |              |         | HVAC /  |        |          | = KITCI  |        |        |         |

+ PROVIDE NEW CIRCUIT BREAKER TO MATCH EXISTING MANUFACTURER AND AIC RATING.







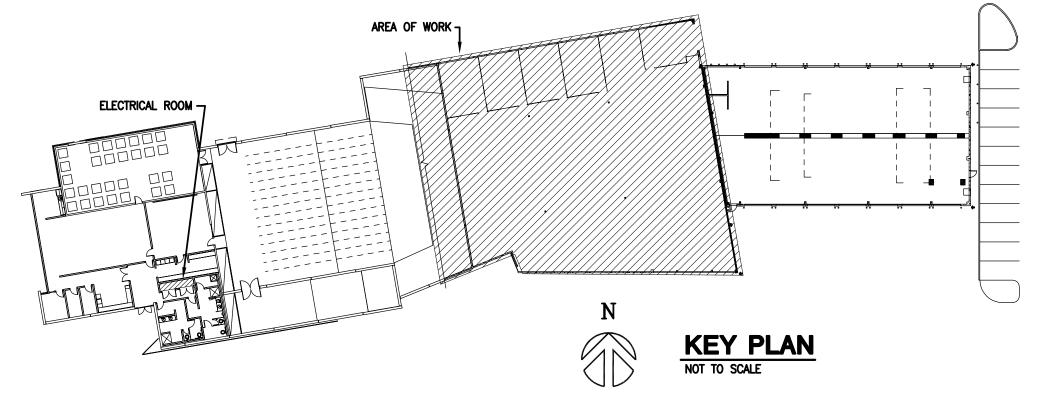
## **OETAIL NOTES**

- INSIDE THE GARAGE AREA.
- CIRCUITS IN THE VICINITY OF THE NORTH WALL TO BE (2-#6 CU; 1-#6 GND) 1"C TO ACCOUNT FOR VOLTAGE DROP. PROVIDE "PIG TAIL" CONNECTORS AT RECEPTACLES SIZED AS NEEDED TO CONNECT THE LARGER WIRE TO THE SMALLER LUGS. LENGTH IN THE FIELD. MAXIMUM VOLTAGE DROP SHALL NOT EXCEED 5% FOR THE ENTIRE CIRCUIT (INCLUDING PANEL FEEDERS). INTERCEPTION AND EXTENSION TO NEW FIXTURE LOCATIONS. SEE LIGHTING PLAN, E-300 DETAIL NOTE 19.
- 3. COORDINATE ROUTING OF NEW HOME RUN CONDUITS THROUGH THE FIRING RANGE WITH OWNER. HOME RUNS FOR THE NEW 120V 4. UPSIZE HOME RUN TO THIS EQUIPMENT TO (2-#8 CU; 1-#8 GND). VERIFY EXACT SIZING REQUIREMENTS WITH ACTUAL CIRCUIT LENGTH IN THE FIELD. MAXIMUM VOLTAGE DROP SHALL NOT EXCEED 5% FOR THE ENTIRE CIRCUIT (INCLUDING PANEL FEEDERS). 5. UPSIZE HOME RUN TO THIS EQUIPMENT TO (2-#10 CU; 1-#10 GND). VERIFY EXACT SIZING REQUIREMENTS WITH ACTUAL CIRCUIT 6. EXISTING FIXTURE TO BE RELOCATED. REMOVE FIXTURE AND PROTECT DURING DEMOLITION. PROTECT EXISTING CIRCUIT FOR
- 7. SWITCH TO BE RELOCATED. SEE NOTE 8, THIS SHEET.
- PRIOR TO INSTALLATION.

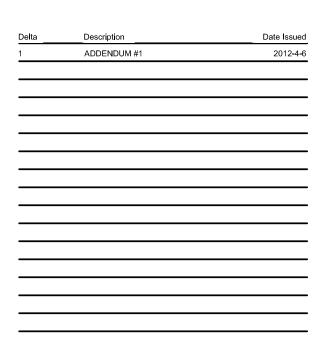
# COVERED PARKING ELECTRICAL PLAN SCALE: 1/8"=1'-0"

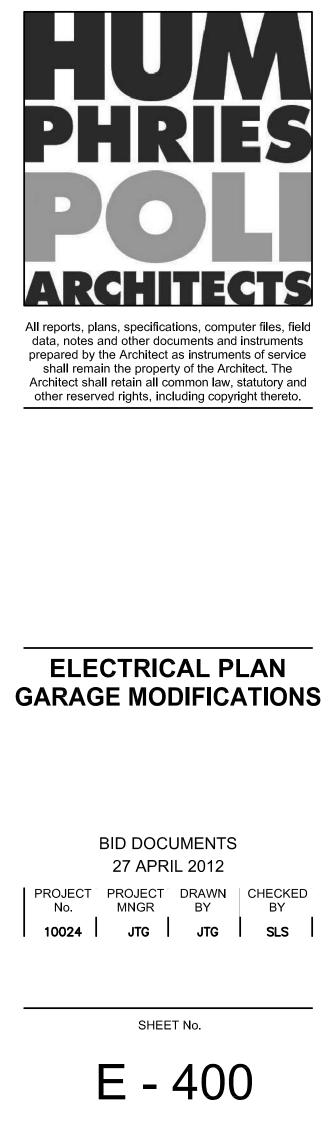
A. NEW AND RELOCATED ITEMS SHOWN AS BOLD \_\_\_\_\_ EXISTING ITEMS SHOWN AS LIGHT \_\_\_\_\_

- 1. EXISTING POWER, LIGHTING, SECURITY, FIRE ALARM, ETC. DEVICES ARE NOT SHOWN. ALL EXISTING DEVICES TO REMAIN. 2. PROVIDE TYPE-WRITTEN PRINTED LABELS ON EACH DEVICE INDICATING SERVING BRANCH CIRCUIT. ALL DEVICES TO BE INSTALLED IN INDUSTRIAL-STYLE STAMPED STEEL SURFACE-MOUNTED OUTLET BOXES TO MATCH APPEARANCE OF EXISTING DEVICES, AND TO BE GFI, UL-LISTED WARTHER-RESISTANT TYPE RECEPTACLE, COLOR GRAY TO MATCH EXISTING. WEATHERPROOF COVERPLATES ARE NOT REQUIRED
- 8. CONNECT RELOCATED 3-WAY SWITCH TO EXISTING SWITCH LEG. INTERCEPT AND EXTEND CIRCUIT TO NEW LOCATION.
- 9. OVERHEAD DOOR OPERATOR. MATCH EXISTING OPERATORS IN THIS GARAGE. PROVIDE 120V, 10, 20A CONNECTION TO OPERATOR. PROVIDE PUSH-BUTTON OPERATION AND COORDINATE SECURITY SYSTEM INTERFACE REQUIREMENTS WITH OWNER'S SECURITY VENDOR
- 10. PROVIDE RECEPTACLE FOR WASH STATION. COORDINATE EXACT LOCATION WITH OWNER PRIOR TO ROUGH-IN.
- 11. UPSIZE ALL WIRING THROUGHOUT THIS CIRCUIT AS NOTED.



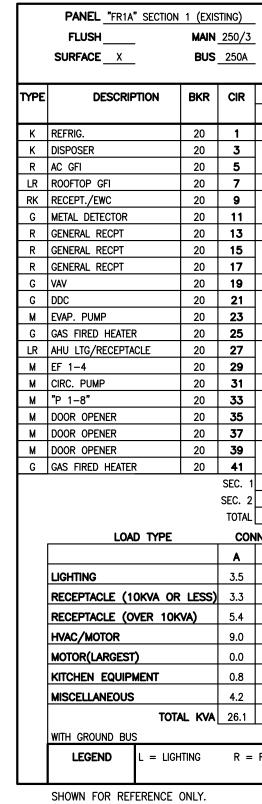




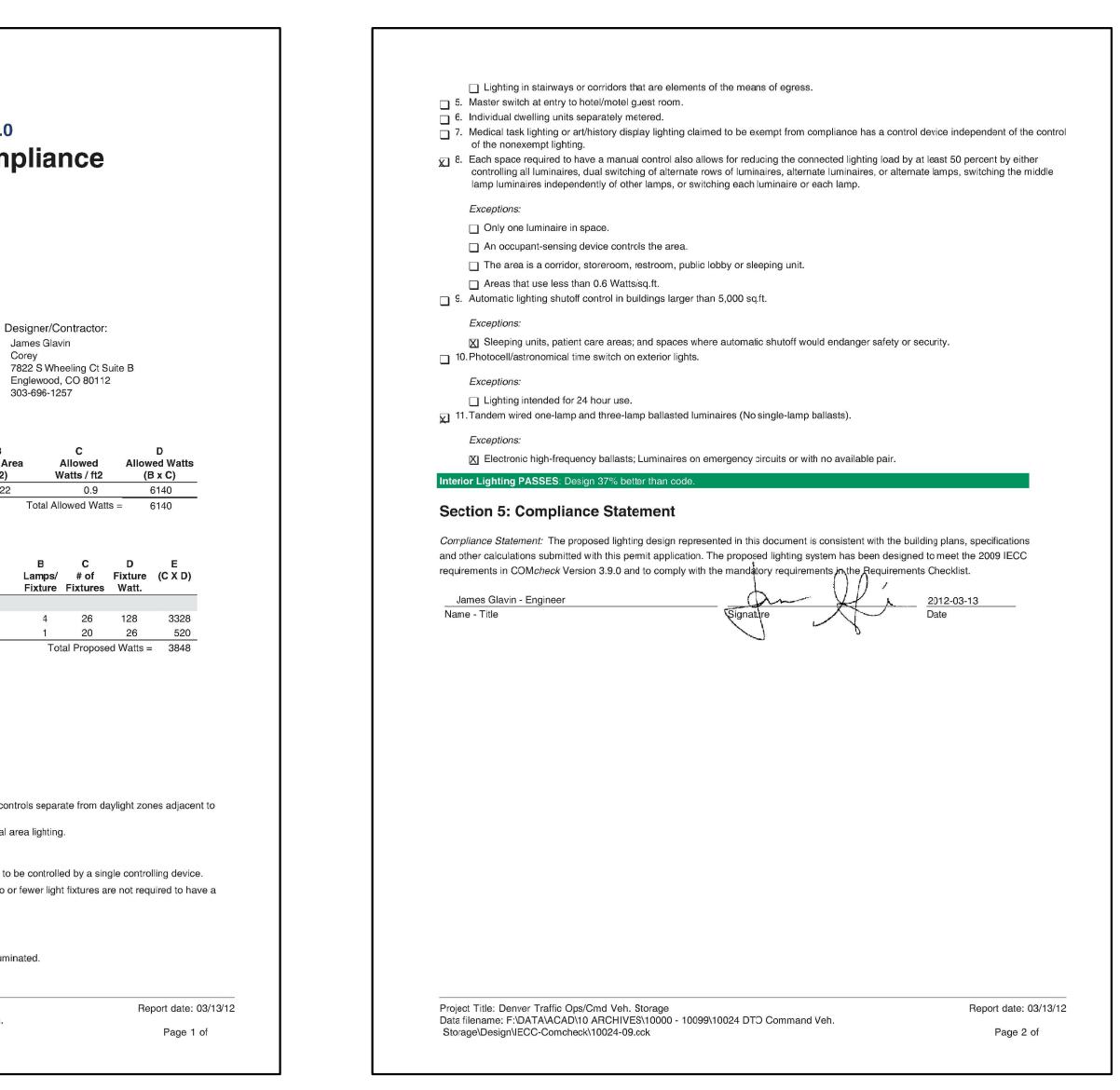


| 2009 IECC                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                 |                                                                                                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                 |                                                                                                |
| Section 1: P                                                                                                                                                                                                                                                                                          | roject Information                                                                                                                                                                                                              |                                                                                                |
| Project Type: New                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                 |                                                                                                |
| Construction Site:<br>Denver, CO                                                                                                                                                                                                                                                                      | over Traffic Ops/Cmd Veh. Storage<br>Owner/Agent:                                                                                                                                                                               |                                                                                                |
| Section 2: In                                                                                                                                                                                                                                                                                         | terior Lighting and Power C                                                                                                                                                                                                     | Calculation                                                                                    |
|                                                                                                                                                                                                                                                                                                       | Α                                                                                                                                                                                                                               |                                                                                                |
|                                                                                                                                                                                                                                                                                                       | Area Category                                                                                                                                                                                                                   | F                                                                                              |
| Section 3: In<br>Fixtu<br>Automotive Facility                                                                                                                                                                                                                                                         | terior Lighting Fixture Sche<br>A<br>Ire ID : Description / Lamp / Wattage Per I<br>(6822 sq.ft.)                                                                                                                               | edule                                                                                          |
| Fixtu<br>Automotive Facility<br>Linear Fluoresce                                                                                                                                                                                                                                                      | terior Lighting Fixture Sche<br>A<br>Ire ID : Description / Lamp / Wattage Per I                                                                                                                                                | ∟amp / Ballast                                                                                 |
| Section 3: In<br>Fixtu<br>Automotive Facility<br>Linear Fluoresce<br>Compact Fluoress<br>Section 4: R<br>Lighting Wa                                                                                                                                                                                  | A<br>Tre ID : Description / Lamp / Wattage Per I<br>(6822 sq.ft.)<br>nt 1: A/AE: Linear / 48" T8 32W / Electronic<br>cent 1: B: Jellyjar / Quad 2-pin 26W / Electronic<br>equirements Checklist<br>ttage:                       | edule<br>_amp / Ballast                                                                        |
| Section 3: In<br>Fixtu<br>Automotive Facility<br>Linear Fluoresce<br>Compact Fluoress<br>Section 4: R<br>Lighting Wa                                                                                                                                                                                  | terior Lighting Fixture Sche<br>a<br>re ID : Description / Lamp / Wattage Per I<br>(6822 sq.ft.)<br>nt 1: A/AE: Linear / 48" T8 32W / Electronic<br>scent 1: B: Jellyjar / Quad 2-pin 26W / Electronic<br>equirements Checklist | edule<br>_amp / Ballast                                                                        |
| Section 3: In<br>Fixtu<br>Automotive Facility<br>Linear Fluoresce<br>Compact Fluoresc<br>Section 4: R<br>Lighting Wa<br>1. Total propose<br>Controls, Sw<br>2. Daylight zone<br>vertical fene                                                                                                         | A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>A                                                                                                                                                              | edule<br>_amp / Ballast<br>onic<br>allowed watts.<br>Complies<br>YES<br>e perimeter have light |
| Section 3: In<br>Fixtu<br>Automotive Facility<br>Linear Fluoresce<br>Compact Fluoresce<br>Compact Fluoresce<br>Section 4: R<br>Lighting Wa<br>1. Total propose<br>Controls, Sw<br>2. Daylight zone<br>vertical fene<br>3. Daylight zone<br><i>Exceptions:</i><br>Contiguou<br>Daylight se<br>separate | A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>A                                                                                                                                                              | edule<br>_amp / Ballast<br>_amp / Ballast<br>_allowed watts.<br>_allowed watts.<br>            |

|           | Panel "Sdpfr" (existi   | NG)    |          |          | V      | DLTAGE  | 277        | /      | 480    | v        | 3      | ø      | 4 W            |           |
|-----------|-------------------------|--------|----------|----------|--------|---------|------------|--------|--------|----------|--------|--------|----------------|-----------|
|           | FLUSH MAIN <u>600/3</u> |        |          |          |        | MLO     |            | -      |        | -        |        | -      |                |           |
|           | SURFACE X               |        | 600A     | -        | FEE    | d thru  |            |        |        | A.I.C.   | 22,000 | FULLY  | RATED          |           |
|           |                         |        |          | •        |        |         |            |        | -      |          |        |        |                |           |
| TYPE      | DESCRIPTION             | BKR    | CIR      |          | LOAD ( | VOLT AN | MPS) /     | PHASE  |        | CIR      | BKR    |        | DESCRIPTION    | TYPE      |
|           |                         |        |          | <b>A</b> |        | В       |            | c      |        |          |        |        |                |           |
| М         | AHU 1-1                 | 70 /   | 1        | 11085    | 14411  |         |            |        |        | 2        | 90 /   | "EF 1- | -5"            | м         |
| м         | -                       |        | 3        |          |        | 11085   | 14411      |        |        | 4        |        | -      |                | м         |
| М         | -                       | / 3    | 5        |          | 1      | 1       |            | 11085  | 14411  | 6        | 3      |        |                | м         |
| М         | AHU 1-2                 | 70 /   | 7        | 11085    | 14411  |         |            | 1      |        | 8        | 90 /   | "EF 1- | -6"            | <u> M</u> |
| М         | -                       |        | 9        |          |        | 11085   | 14411      |        |        | 10       |        | -      |                | M         |
| M         | -                       | 3      |          |          |        | 1       |            | 11085  | 14411  | 12       | 3      |        |                | M         |
| LRMKG     | PANEL "FR1A"            | 100    | 13       | 26112    | 13052  | 07070   | 47050      | ı      |        | 14       | 80     | ROOF   | rop unit "1-3" | <u>M</u>  |
|           | -                       | 3      | 15<br>17 |          |        | 2/2/2   | 13052      | 26002  | 17050  | 16       | 3      | -      |                | <u>M</u>  |
| LRMG<br>L | <br>GARAGE_LTG          | 20     | 19       | 3528     | 34503  | 1       |            | 20002  | 13032  | 18<br>20 | 200 /  |        | RELOCATED)     | <u>м</u>  |
| L         | OFFICE AREA LTG         | 20     | 21       | 3320     | 04000  | 2688    | 34503      | ו      |        | 20       |        |        |                | M         |
| L         | OFFICE AREA LTG         | 20     | 23       |          |        | 2000    | 04000      | 1600   | 34503  | 24       | 3      | _      |                | M         |
| L         | EXTERIOR LTG            | 20     | 25       | 1346     | 1330   | ]       |            |        | 101000 | 26       | 15 /   |        | "P 1–5"        | м         |
| L         | FIRING RANGE LTG        | 20     | 27       |          |        | 2048    | 1330       | ן      |        | 28       |        | _      |                | м         |
| м         | "EF 1-7" / "EF 1-8"     | 15 /   | 29       | 1        |        |         |            | 1871   | 1330   | 30       | 3      | -      |                | м         |
| м         | _                       |        | 31       | 1871     | 1330   |         |            |        |        | 32       | 15 /   | PUMP   | "P 1–6"        | м         |
| М         | -                       | 3      | 33       |          |        | 1871    | 1330       |        | -      | 34       |        | -      |                | м         |
|           | SPACE                   |        | 35       |          |        |         |            | 0      | 1330   | 36       | 3      | -      |                | м         |
|           | SPACE                   |        | 37       | 0        | 0      |         |            | ,      |        | 38       |        | SPACE  |                |           |
|           | SPACE                   |        | 39       |          |        | 0       | 0          |        |        | 40       |        | SPACE  |                |           |
|           | SPACE                   |        | 41       |          |        |         |            | 0      | 0      | 42       |        | SPACE  |                |           |
|           |                         |        |          | 134064   |        | 135086  |            | 130680 |        |          |        |        |                |           |
|           | LOAD TYPE               |        | CON      | NECTED   | KVA    | TOT     | <b>FAL</b> | FAC    | TOR    | DE       | EMAND  | KVA    | TOTAL          | -         |
|           |                         |        | A        | В        | С      | ALL F   | PHASES     |        |        | A        | В      | С      | ALL PHASES     |           |
|           | LIGHTING                |        | 8.4      | 9.1      | 4.9    | 22.4    |            | 125%   |        | 10.5     | 11.4   | 6.1    | 28.0           |           |
|           | RECEPTACLE (10KVA OR    | LESS)  | 3.3      | 3.3      | 3.3    | 10.0    |            | 100%   |        | 3.3      | 3.3    | 3.3    | 10.0           |           |
|           | RECEPTACLE (OVER 10K    |        | 5.4      | 6.7      | 5.0    | 17.1    |            | 50%    |        | 2.7      | 3.3    | 2.5    | 8.5            |           |
|           | HVAC/MOTOR              |        | 112.0    | 110.0    | 111.5  | 333.5   |            | 100%   |        | 112.0    | 110.0  | 111.5  | 333.5          |           |
|           | MOTOR(LARGEST)          |        | 0.0      | 0.0      | 0.0    | 0.0     |            | 125%   |        | 0.0      | 0.0    | 0.0    | 0.0            |           |
|           | KITCHEN EQUIPMENT       |        | 0.8      | 1.2      | 0.0    | 1.9     |            | 100%   |        | 0.8      | 1.2    | 0.0    | 1.9            |           |
|           | MISCELLANEOUS           |        | 4.2      | 4.8      | 6.0    | 15.0    |            | 100%   |        | 4.2      | 4.8    | 6.0    | 15.0           |           |
|           | τοτλ                    | AL KVA | 134.1    | 135.1    | 130.7  | 399.8   |            | тот/   | AL KVA | 133.5    | 134.0  | 129.4  | 396.9          |           |
|           | WITH GROUND BUS         |        |          |          |        |         |            | TOTAL  | . AMPS | 481.8    | 483.9  | 467.1  | 477.4          |           |
|           | <b>LEGEND</b> L = LIGH  | ITING  | R =      | RECEPT   | ACLE   | M = H   | HVAC /     | MOTOR  | к      | = Kitcł  | IEN    | G = M  | ISCELLANEOUS   |           |
|           |                         |        |          |          |        |         |            |        |        |          |        |        |                | 1         |



SHOWN FOR REFERENCE ONLY.

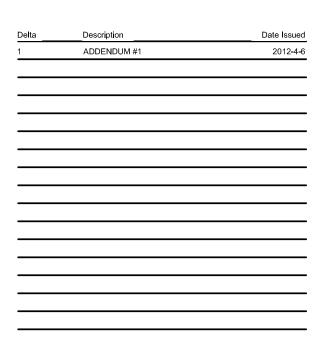


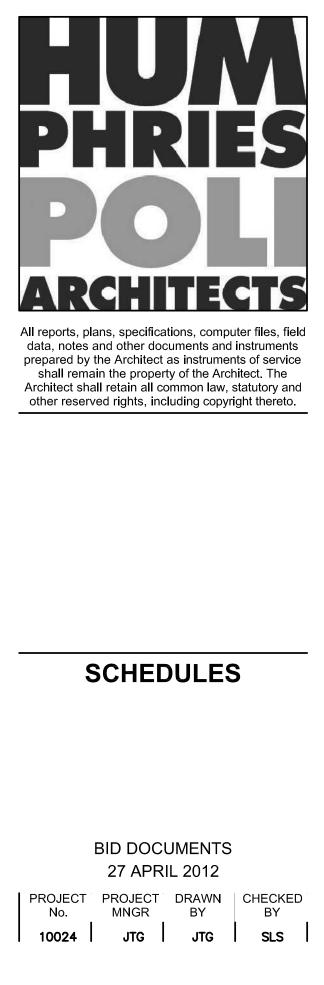
|   |        | VO    | LTAGE | 120       | 1     | 208   | V               | 3        | ø      | 4                              | _ w        |           |
|---|--------|-------|-------|-----------|-------|-------|-----------------|----------|--------|--------------------------------|------------|-----------|
|   |        |       | MLO   |           |       |       |                 |          |        |                                |            |           |
|   |        | FEED  | THRU  | FR1A2     |       |       | A.I.C.          | 10,000   |        |                                |            |           |
|   |        |       |       |           |       |       |                 |          |        |                                |            |           |
|   |        | LOAD  | (VOLT | AMPS)     | / PHA | SE    | CIR             | BKR      | D      | ESCRIPTIO                      | N          | TYPE      |
|   | A      |       | В     |           | С     |       |                 |          |        |                                |            |           |
|   | 750    | 540   |       |           |       |       | 2               | 20       | FURNIT | URE                            |            | R         |
|   |        |       | 864   | 540       |       |       | 4               | 20       | FURNIT | URE                            |            | R         |
|   |        |       |       | l         | 360   | 540   | 6               | 20       | FURNIT |                                |            | R         |
|   | 640    | 540   |       |           |       |       | 8               | 20       | FURNIT |                                |            | <u>R</u>  |
| _ |        |       | 840   | 900       | 200   | 190   | 10              | 20       |        | RECPT                          |            | R         |
|   | 720    | 540   |       | l         | 200   | 180   | <u>12</u><br>14 | 20<br>20 |        | RECPT<br>RECPT                 |            | R         |
|   | 720    | 540   | 720   | 360       |       |       | 16              | 20       |        | COUNTER                        |            | R         |
|   |        |       | 0     |           | 1080  | 180   | 18              | 20       | MENS   |                                |            | R         |
|   | 200    | 180   |       | L.        |       |       | 20              | 20       | WOMEN  | S RR                           |            | R         |
|   |        |       | 100   | 720       |       |       | 22              | 20       | BOILER |                                |            | G         |
|   |        |       |       |           | 696   | 720   | 24              | 20       | BOILER |                                |            | G         |
|   | 200    | 500   |       |           |       |       | 26              | 20       | EVAP F | PUMP                           |            | м         |
|   |        |       | 280   | 200       |       |       | 28              | 20       | GAS FI | RED HEATER                     | <u> </u>   | G         |
|   |        |       |       | l         | 696   | 280   | 30              | 20       |        | G/RECEPTA                      |            |           |
|   | 60     | 750   | 450   | 400       |       |       | 32              | 20       |        | 3"/"P 1-4"                     |            | <u> M</u> |
|   |        |       | 450   | 400       | 864   | 400   | 34<br>36        | 20<br>20 |        | - <u>6"DAMPER</u><br>-5"DAMPER |            | <u>M</u>  |
|   | 864    | 864   |       | l         | 004   | 400   | 38              | 20       |        | OPENER                         |            | M         |
|   |        |       | 864   | 864       |       |       | 40              | 20       |        | OPENER                         |            | м         |
|   |        |       |       |           | 100   | 500   | 42              | 20       | EVAP C | COOLER                         |            | G         |
| 1 | 7348   |       | 8102  |           | 6796  |       |                 |          |        |                                |            |           |
| 2 | 18764  |       | 19170 |           | 19206 |       |                 |          |        |                                |            |           |
| • | 26112  |       | 27272 |           | 26002 |       |                 |          |        |                                |            |           |
| N | NECTE  | ) KVA | то    | TAL       | FA    | CTOR  | DE              | MAND     | KVA    | TO                             | <u>ral</u> | _         |
|   | В      | С     | ALL   | PHASES    |       |       | A               | В        | С      | ALL PH                         | ASES       |           |
|   | 4.4    | 3.3   | 11.2  |           | 125%  |       | 4.4             | 5.5      | 4.1    | 13                             | .9         |           |
|   | 3.3    | 3.3   | 10.0  |           | 100%  |       | 3.3             | 3.3      | 3.3    | 10                             | .0         |           |
|   | 6.7    | 5.0   | 17.1  |           | 50%   |       | 2.7             | 3.3      | 2.5    | 8                              | .5         |           |
|   | 7.0    | 8.4   | 24.3  |           | 100%  |       | 9.0             | 7.0      | 8.4    | 24                             | .3         |           |
|   | 0.0    | 0.0   | 0.0   |           | 125%  |       | 0.0             | 0.0      | 0.0    | 0                              | .0         | 7         |
|   | 1.2    | 0.0   | 1.9   |           | 90%   |       | 0.7             | 1.0      | 0.0    | 1                              | .7         | 7         |
|   | 4.8    | 6.0   | 15.0  |           | 100%  |       | 4.2             | 4.8      | 6.0    | 15                             |            | 1         |
|   | 27.3   | 26.0  | 79.4  |           |       | L KVA | 24.2            | 24.9     | 24.3   | 73                             |            | 1         |
|   | 27.0   | 20.0  |       |           |       | AMPS  |                 | 207.8    | 202.5  | 203                            |            | -         |
|   | RECEPT |       | м — ч | -IVAC / I |       |       | = KITCH         |          |        | ISCELLANEO                     |            | 1         |
|   | NEGEFT |       | w — r |           | MOTOR | n     |                 |          | 5 – M  |                                | 00         |           |

|               | FLUSH                | MAIN   |                 | _              |       | MLO X      |         |      |                 |          |             |               |          |
|---------------|----------------------|--------|-----------------|----------------|-------|------------|---------|------|-----------------|----------|-------------|---------------|----------|
|               |                      | BUS    | 250A            |                | FEED  | THRU       |         |      | A.I.C.          | 10,000   |             |               |          |
| YPE           | DESCRIPTION          | BKR    | CIR             | LOAD (VOLT AMP |       |            | / PHASE |      | CIR             | BKR      | DESCRIPTION |               | TYPE     |
|               |                      |        |                 | A              |       | В          | С       |      |                 |          |             |               |          |
| L             | RANGE TRACK LTG      | 20     | 43              | 750            | 200   |            |         |      | 44              | 20       | FIRING      | RANGE LTG BAR | (        |
| L             | RANGE TRACK LTG      | 20     | 45              |                |       | 750 0      |         |      | 46              | 20       | SPARE       |               |          |
| L             | RANGE TRACK LTG      | 20     | 47              |                |       |            | 750     | 200  | 48              | 20       | co co       | NTROLLER      |          |
| L             | RANGE TRACK LTG      | 20     | 49              | 750            | 400   | I          | I       |      | 50              | 20       | GARAGE      | E DAMPER      | <b> </b> |
| L             | RANGE TRACK LTG      | 20     | 51              |                |       | 750 1080   |         |      | 52              | 20       |             | RECEPT        |          |
| L             | RANGE TRACK LTG      | 20     | 53              |                |       | 1          | 750     | 1080 | 54              | 20       |             | R RECEPT      |          |
| L             | RANGE TRACK LTG      | 20     | 55              | 750            | 1080  |            | 1       |      | 56              | 20       |             | R RECEPT      | _        |
| <u>L</u>      | RANGE TRACK LTG      | 20     | 57              |                |       | 750 1080   |         |      | 58              | 20       |             | RECEPT        |          |
| L             | RANGE TRACK LTG      | 20     | 59              | 750            |       | 1          | 750     | 1080 | 60              | 20       |             | R RECEPT      | <u> </u> |
| <u>L</u>      | RANGE TRACK LTG      | 20     | 61              | 750            | 616   | 750 000    | 1       |      | 62              | 20       | EF 1-       | •             | N        |
| L             | RANGE TRACK LTG      | 20     | 63              |                |       | 750 600    | 700     | 800  | 64              | 20       | EF 1-9      |               | _        |
| <u>G</u>      | GAS WATER HEATER     | 20     | 65              | 360            | 900   |            | 300     | 800  | 66              | 15       | COMPR       | ESSUR         |          |
| <u>G</u>      | HEAT TAPE            | 20     | <u>67</u>       | 360            | 800   | 900 800    | 1       |      | <u>68</u><br>70 | / 7      | _           |               |          |
| L             | SITE LTG             | 20     | <u>69</u><br>71 |                |       | 900 800    | 900     | 1000 | <u>70</u><br>72 | 20 /     |             | 01 1 1        | -        |
| <u>լ</u><br>լ | SITE LTG             | 15     | 73              | 400            | 1000  |            | 900     | 1000 | 74              | 20 2     |             | CU 1-1        |          |
| L             |                      | 2      | 75              | +00            | 1000  | 400 100    |         |      | 76              | 20       | DAMPE       | >             |          |
| M             | HOOD DAMPER          | 20     | 77              |                |       |            | 500     | 200  | 78              | 20       | CONTAC      |               |          |
| R             | LOCKER RM RECEPT     | 20     | 79              | 360            | 10548 |            | 000     | 200  | 80              | 100 /    | PANEL       |               | R        |
| M             | EF 1–13              | 20     | 81              |                | 10010 | 528 10682  | l       |      | 82              | ///      | _           |               | R        |
|               | SPACE                |        | 83              |                | I     |            | 0       | 0896 | 84              | 3        | _           |               | R        |
|               |                      |        |                 | 18764          |       | 19170      | 19206   |      |                 | <u> </u> |             |               |          |
|               | LOAD TYPE            |        | CON             | INECTED        | ) KVA | TOTAL      | FACT    | DR   | DE              | MAND     | KVA         | TOTAL         |          |
|               |                      |        | A               | в              | С     | ALL PHASES |         |      | Α               | В        | c           | ALL PHASES    | 1        |
|               | LIGHTING             |        | 3.4             | 4.3            | 3.2   | 10.9       | 125%    |      | 4.3             | 5.4      | 3.9         | 13.6          |          |
|               |                      |        |                 |                |       |            | 100%    |      |                 |          |             | 10.0          |          |
|               | RECEPTACLE (10KVA OF |        |                 | 3.3            | 3.3   | 10.0       |         |      | 3.3             | 3.3      | 3.3         |               | -        |
|               | RECEPTACLE (OVER 10k | (VA)   | 2.3             | 3.4            | 2.5   | 8.2        | 50%     |      | 1.2             | 1.7      | 1.3         | 4.1           | -        |
|               | HVAC/MOTOR           |        | 5.9             | 4.4            | 5.7   | 16.0       | 100%    |      | 5.9             | 4.4      | 5.7         | 16.0          | 4        |
|               | MOTOR(LARGEST)       |        | 0.0             | 0.0            | 0.0   | 0.0        | 125%    |      | 0.0             | 0.0      | 0.0         | 0.0           |          |
|               | KITCHEN EQUIPMENT    |        | 0.0             | 0.0            | 0.0   | 0.0        | 100%    |      | 0.0             | 0.0      | 0.0         | 0.0           |          |
|               | MISCELLANEOUS        |        | 3.8             | 3.8            | 4.5   | 12.0       | 100%    |      | 3.8             | 3.8      | 4.5         | 12.0          | 1        |
|               |                      | AL KVA |                 | 19.2           | 19.2  | 57.1       | TOTAL   | KVA  |                 | 18.5     | 18.7        | 55.7          | 1        |
|               |                      |        | 10.0            | 10.2           | 10.2  | 07.1       |         |      |                 |          |             |               |          |
|               | WITH GROUND BUS      |        |                 |                |       |            | TOTAL   |      |                 |          |             | 154.7         | 1        |
|               | LEGEND L = LIG       | HTING  | R =             | RECEPT         | ACLE  | M = HVAC / | MOTOR   | K    | = KITCH         | IEN      | G = M       | ISCELLANEOUS  |          |

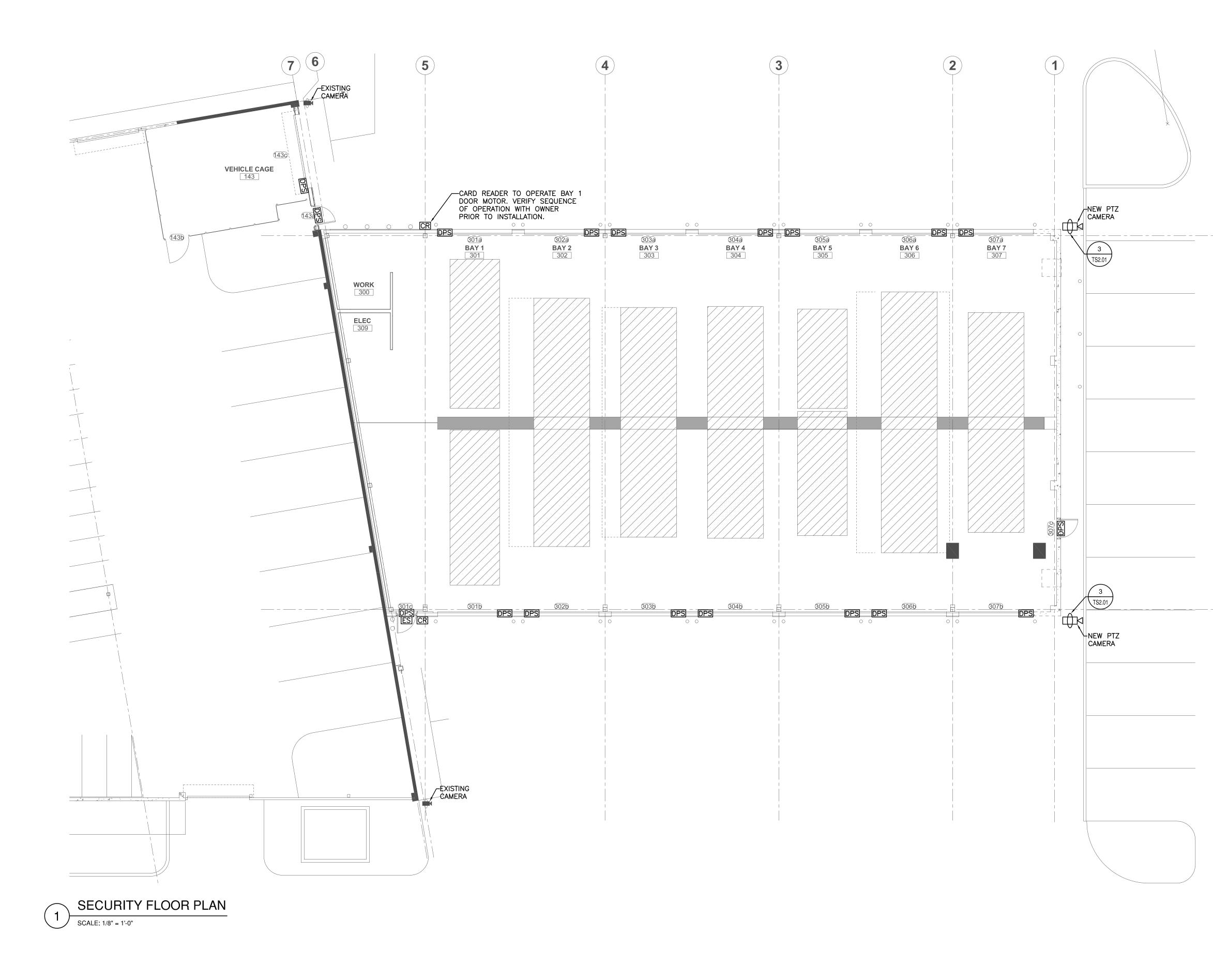


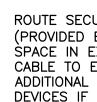
Denver Traffic Operations Command Vehicle Storage & Modifications 3501 Park Avenue Denver, CO 80216





SHEET No.





## GENERAL SHEET NOTES:

1. ROUTE SECURITY CABLE THROUGH RACEWAY (PROVIDED BY EC) AND STUB TO ACCESSIBLE SPACE IN EXISTING BUILDING. FREE-WIRE CABLE TO EXISTING IDS PANEL AND PROVIDE ADDITIONAL CAPACITY FOR NEW SECURITY DEVICES IF SPARE INPUTS ARE NOT AVAILABLE.

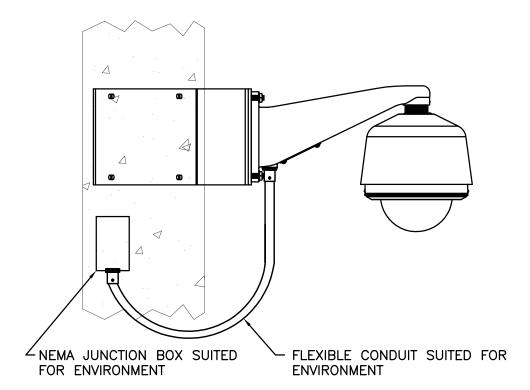
## SECURITY NOTES

- 1. ALL EMPTY CONDUITS SHALL BE CLEANED, CAPPED, LABELED AND FURNISHED WITH A PULL STRING.
- 2. EC TO FURNISH AND INSTALL ALL CONDUITS AND BACK BOXES FOR ALL SYSTEMS AND DEVICES AS SHOWN ON THE DRAWINGS.
- 3. THERE SHALL BE ONE PULL BOX FOR EVERY 100 FEET OF CONDUIT AND A PULL BOX IF MORE THAN 180 DEGREES OF BEND ARE REQUIRED IN ANY RUN.
- 4. EC TO CONSOLIDATE CONDUITS FOR LIKE DEVICE VIA COLLECTION BOXES WHERE POSSIBLE. 5. ELECTRICAL FEEDS SHOULD NOT RUN PARALLEL
- WITH SECURITY SYSTEM CONDUIT. IF ELECTRICAL FEEDS CROSS SECURITY CONDUITS, THEY MUST CROSS AT 90-DEGREES.
- 6. AVOID ROUTING SECURITY CABLES NEAR SOURCES OF EMI. KEEP A MINIMUM CLEARANCE OF 4 FEET FROM POWER TRANSFORMERS AND MOTORS AND 6 INCHES FROM ALL CONDUIT AND CABLE USED FOR POWER DISTRIBUTION.
- 7. SC TO COORDINATE WITH GC TO ENSURE ALL SECURITY COMPONENTS ARE GROUNDED AND SURGE PROTECTED. 8. SECURITY CABLE SHALL NOT REST DIRECTLY ON
- ANY BUILDING STRUCTURE, PIPING, DUCT, ETC. AND SHALL BE SUPPORTED BY J-HOOKS OR APPROVED METHOD. SUPPORT METHOD SHALL HAVE A 5 FOOT SPACING MAXIMUM.
- 9. SC IS RESPONSIBLE FOR FIRE STOPPING THE CONDUITS, SLEEVES AND CORES THAT ARE DESIGNATED FOR USE BY THE SC. FOLLOW LOCAL CODES UNLESS OTHERWISE NOTED. 10. SC TO FURNISH DPS TO MATCH DEVICES AND
- INSTALLATION METHOD IN USE ON EXISTING BUILDING. 11. CONNECT NEW DPS DEVICES TO EXISTING IDS
- SYSTEM. COORDINATE WORKFLOW AND PROGRAMMING WITH OWNER.
- 12. SC TO FURNISH AND INSTALL A DPS FOR ALL EXTERIOR DOORS. THIS INCLUDES ALL MAN DOORS, BAY DOORS, AND ROOF HATCHES.
- 13. NOT ALL EQUIPMENT MAY BE SHOWN THAT MAY BE REQUIRED FOR OPERATION. PROVIDE ALL EQUIPMENT NECESSARY FOR A COMPLETE AND FUNCTIONAL SYSTEM.

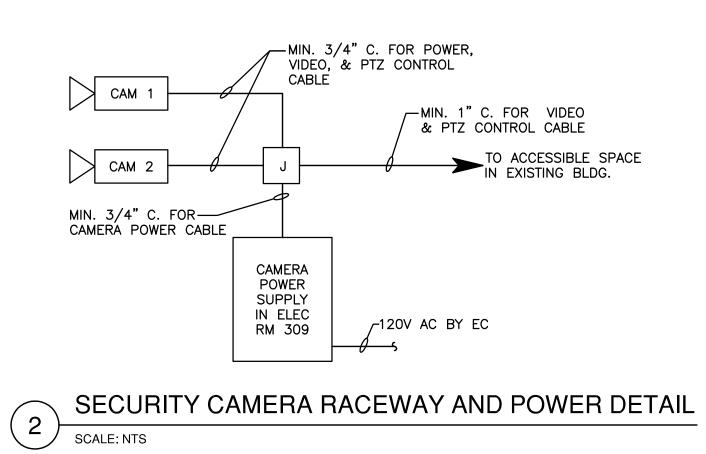
| SYMBOLS     |                         |  |  |  |  |  |  |
|-------------|-------------------------|--|--|--|--|--|--|
|             |                         |  |  |  |  |  |  |
| <u>SECU</u> | RITY DEVICES            |  |  |  |  |  |  |
|             | CCTV CAMERA             |  |  |  |  |  |  |
|             | DOME CAMERA             |  |  |  |  |  |  |
|             | PTZ CAMERA              |  |  |  |  |  |  |
| ACP         | ACCESS CONTROL PANEL    |  |  |  |  |  |  |
| CC          | CONTROL CONSOLE         |  |  |  |  |  |  |
| CB          | CRASH BAR               |  |  |  |  |  |  |
| CR          | CARD READER             |  |  |  |  |  |  |
| DA          | DOOR ALARM              |  |  |  |  |  |  |
| DR          | DOOR RELEASE            |  |  |  |  |  |  |
| DPS         | DOOR POSITION SWITCH    |  |  |  |  |  |  |
| EL          | ELECTRIC LOCK           |  |  |  |  |  |  |
| ES          | ELECTRIC STRIKE         |  |  |  |  |  |  |
| IAP         | INTRUSION ALARM PANEL   |  |  |  |  |  |  |
| GB          | GLASS BREAK             |  |  |  |  |  |  |
| HS          | HORN STROBE             |  |  |  |  |  |  |
| IC          | INTERCOM STATION        |  |  |  |  |  |  |
| ICM         | INTERCOM MASTER STATION |  |  |  |  |  |  |
| KP          | KEYPAD                  |  |  |  |  |  |  |
| MAG         | MAGNETIC LOCK           |  |  |  |  |  |  |
| MON         | MONITOR                 |  |  |  |  |  |  |
| Ρ           | PANIC                   |  |  |  |  |  |  |
| PB          | PUSH BUTTON             |  |  |  |  |  |  |
| PS          | POWER SUPPLY            |  |  |  |  |  |  |
| REX         | REQUEST TO EXIT         |  |  |  |  |  |  |
| SR          | SIREN                   |  |  |  |  |  |  |
| WR          | WIRELESS RECEIVER       |  |  |  |  |  |  |
| WS          | WORKSTATION             |  |  |  |  |  |  |
| [WT]        | WIRELESS TRANSMITTER    |  |  |  |  |  |  |

Ά

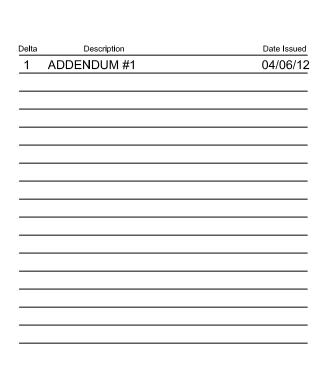
(B)

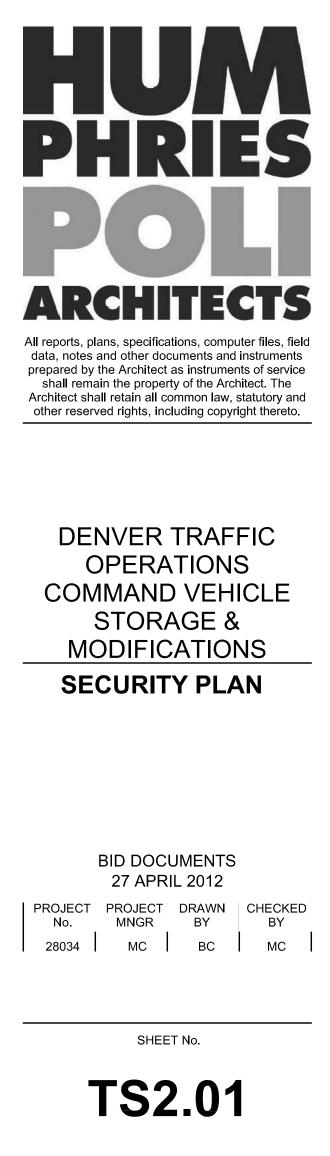


### SECURITY CAMERA PARAPET MOUNT DETAIL (3 SCALE: NTS









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